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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.

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2213A
OSCILLOSCOPE

SERVICE

INSTRUCTION MANUAL

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

070-4733-00
Product Group 46

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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, 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.

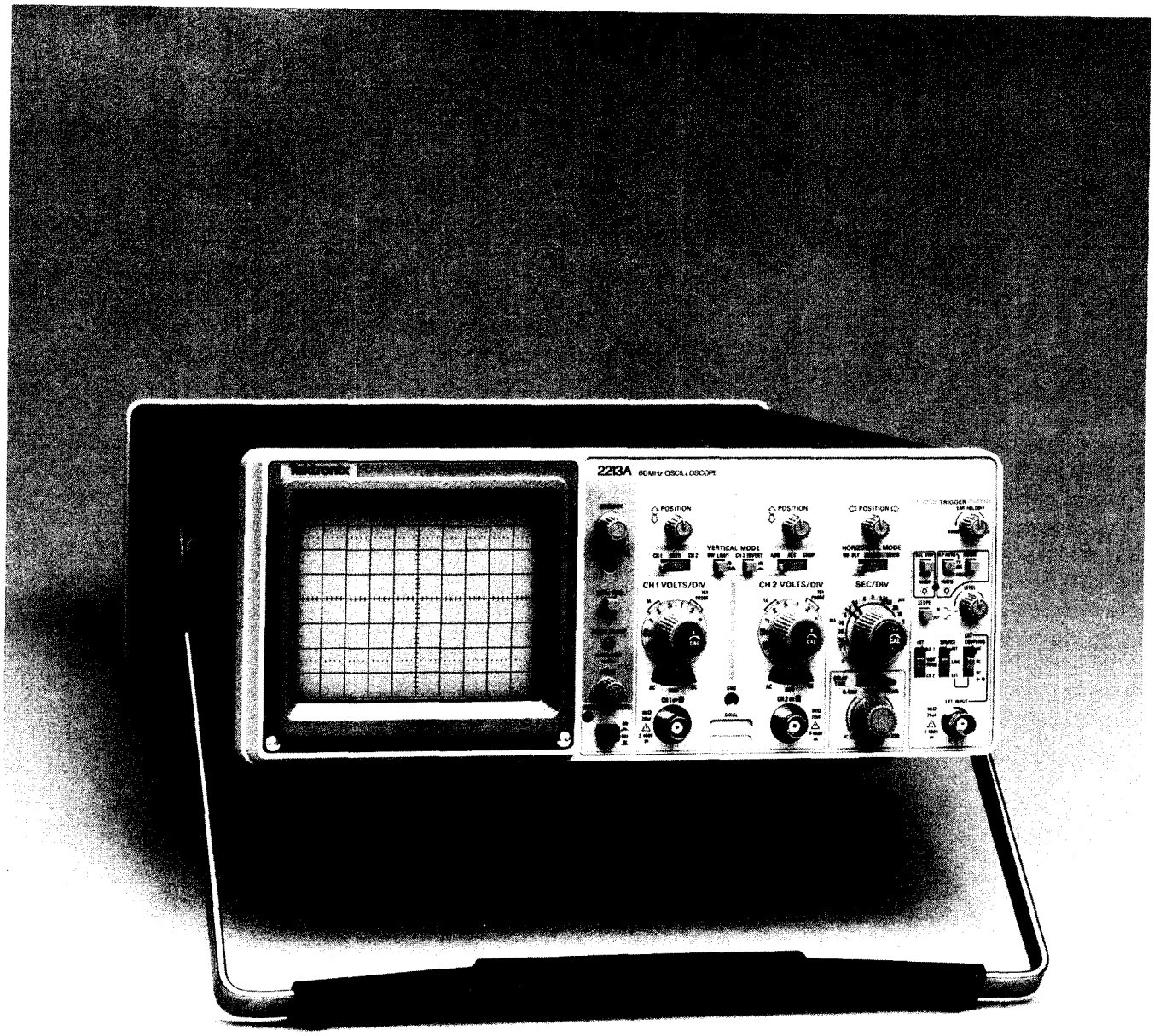
Use Care When Servicing With Power On

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.



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The 2213A Oscilloscope.

SPECIFICATION

INTRODUCTION

The TEKTRONIX 2213A 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. A X10 magnifier circuit extends the maximum sweep speed to 5 ns per division when the SEC/DIV switch is set to 0.05 μs 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 further information about both standard and optional accessories, refer to the "Accessories" page at the back of this manual. Your Tektronix representative, local Tektronix Field Office, or Tektronix product catalog can also provide accessories information.

PERFORMANCE CONDITIONS

The following electrical characteristics (Table 1-1) are valid for the 2213A 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.

Environmental characteristics are given in Table 1-2. The 2213A 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.

Physical characteristics of the instrument are listed in Table 1-3.

Table 1-1
Electrical Characteristics

Characteristics	Performance Requirements	Supplemental Information
VERTICAL DEFLECTION SYSTEM		
Deflection Factor		5 mV per division to 5 V per division gain is adjusted with VOLTS/DIV switch set to 10 mV per division. 2 mV per division gain is adjusted with VOLTS/DIV switch set to 2 mV per division
Range	2 mV per division to 5 V per division in a 1-2-5 sequence	
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: $\frac{0.35}{\text{Bandwidth (}-3\text{ dB)}}$
Rise Time		
0°C to +35°C		
5 mV per Division to 5 V per Division	5.8 ns or less.[a]	
0°C to +50°C		
2 mV per Division to 5 V per Division	7.0 ns or less.[a]	
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.[a]	
AC Coupled Lower Limit	10 Hz or less at −3 dB.[a]	
Bandwidth Limiter	Upper limits (−3 dB) bandpass at 10 MHz ±15%.	
Chop Mode Switching Rate	500 kHz ±30%.[a]	
Input Characteristics		
Resistance	1 MΩ ±2%.[a]	
Capacitance	20 pF ±2 pF.[a]	

[a]**Performance Requirement not checked in Service Manual.**

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
VERTICAL DEFLECTION SYSTEM (cont)		
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.[a]	
AC Coupled	400 V (dc + peak ac) or 800 V ac p-p to 10 kHz or less.[a]	
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.[a]	VOLTS/DIV Variable control in CAL detent.
Trace Shift as VOLTS/DIV Variable Control is Rotated	1.0 division or less.[a]	
Trace Shift with Invert	1.5 division or less.[a]	
Channel Isolation	Greater than 100 to 1 at 25 MHz.	
TRIGGER SYSTEM		
TRIGGER Sensitivity		External trigger signal from a 50 Ω source driving a 50 Ω coaxial cable terminated in 50 Ω at the input connector.
P-P AUTO/TV LINE and NORM Modes	**5 MHz** / **60 MHz**	
Internal	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.[a]	
TV FIELD Mode	1.0 division of composite sync.[a]	
EXT INPUT		
Maximum Input Voltage ⚠	400 V (dc + peak ac) or 800 V ac p-p at 10 kHz or less.[a]	See Figure 1-1 for derating curve.
Input Resistance	1 MΩ ±2%.[a]	
Input Capacitance	20 pF ±2.5 pF.[a]	
AC Coupled	10 Hz or less at lower −3 dB point.[a]	
LEVEL Control Range (NORM)		
INT	Can be set to any point of the trace that can be displayed.[a]	
EXT, DC	At least ±1.6 V, 3.2 V p-p.	
EXT, DC ÷ 10	At least ±16 V, 32 V p-p.[a]	
VAR HOLDOFF Control	Increases A Sweep holdoff time by at least a factor of 10.[a]	

[a]**Performance Requirement not checked in Service Manual.**

Table 1-1 (cont)

Characteristics	Performance Requirements		Supplemental Information
HORIZONTAL DEFLECTION SYSTEM			
Sweep Rate	0.5 s per division to 0.05 μs per division in a 1-2-5 sequence. X10 magnifier extends maximum sweep speed to 5 ns per division.		
Accuracy	**Unmagnified**	**Magnified**	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	±3%	±4%	
0°C to +50°C	±4%[a]	±5%[a]	
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	±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 sweep speed by at least a factor of 2.5.		
Delay Time			
Delay Positions	Minimum less than 1.0 μs, 20 μs, and 0.4 ms.		
MULTIPLIER	Increases delay time by at least a factor of 50.		
Jitter	One part or less in 10,000 (0.01%) of the maximum available delay time.		
X-Y OPERATION (X1 MAGNIFICATION)			
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	±4%.		
Y-Axis	Same as Vertical Deflection System.[a]		
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.[a]		
Phase Difference Between X- and Y-Axis Amplifiers	±3° from dc to 100 kHz.[a]		With dc-coupled inputs.

[a]**Performance Requirement not checked in Service Manual.**

Table 1-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
	PROBE ADJUST	
Output Voltage of PROBE ADJUST Jack	0.5 V ±5%.	
Repetition Rate	1 kHz ±20%.[a]	
	Z-AXIS INPUT	
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.[a]	
Input Resistance	10 kΩ ±10%.[a]	
	POWER SOURCE	
Line Voltage Ranges	90 V to 250 V.[a]	
Line Frequency	48 Hz to 440 Hz.[a]	
Maximum Power Consumption	40 W (70 VA).[a]	
Line Fuse	1.0 A, 250 V, slow-blow.	
	CATHODE-RAY TUBE	
Display Area	80 by 100 mm.[a]	
Standard Phosphor	P31.[a]	
Nominal Accelerating Voltage	14 kV.[a]	

[a]**Performance Requirement not checked in Service Manual.**

Table 1-2
Environmental Characteristics

Characteristics	Description
	NOTE *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.*
Temperature	
Operating	0°C to +50°C (+32°F to +122°F).
Nonoperating	−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.
Altitude	
Operating	To 4,500 m (15,000 ft). Maximum operating temperature decreased 1°C per 1,000 ft above 5,000 ft.
Nonoperating	To 15,000 m (50,000 ft).
Humidity (Operating and Nonoperating)	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.
Vibration (Operating)	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.
Shock (Operating and Nonoperating)	30 g's, half-sine, 11-ms duration, 3 shocks per axis each direction, for a total of 18 shocks.
EMI	Meets radiated and conducted emission requirements per VDE 0871 Class B.

Table 1-3
Physical Characteristics

Characteristics	Description
Weight With Power Cord	
With Cover, Probes, and Pouch	6.0 kg (13.1 lb).
Without Cover, Probes, and Pouch	5.0 kg (10.9 lb).
Domestic Shipping Weight	7.0 kg (15.4 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).

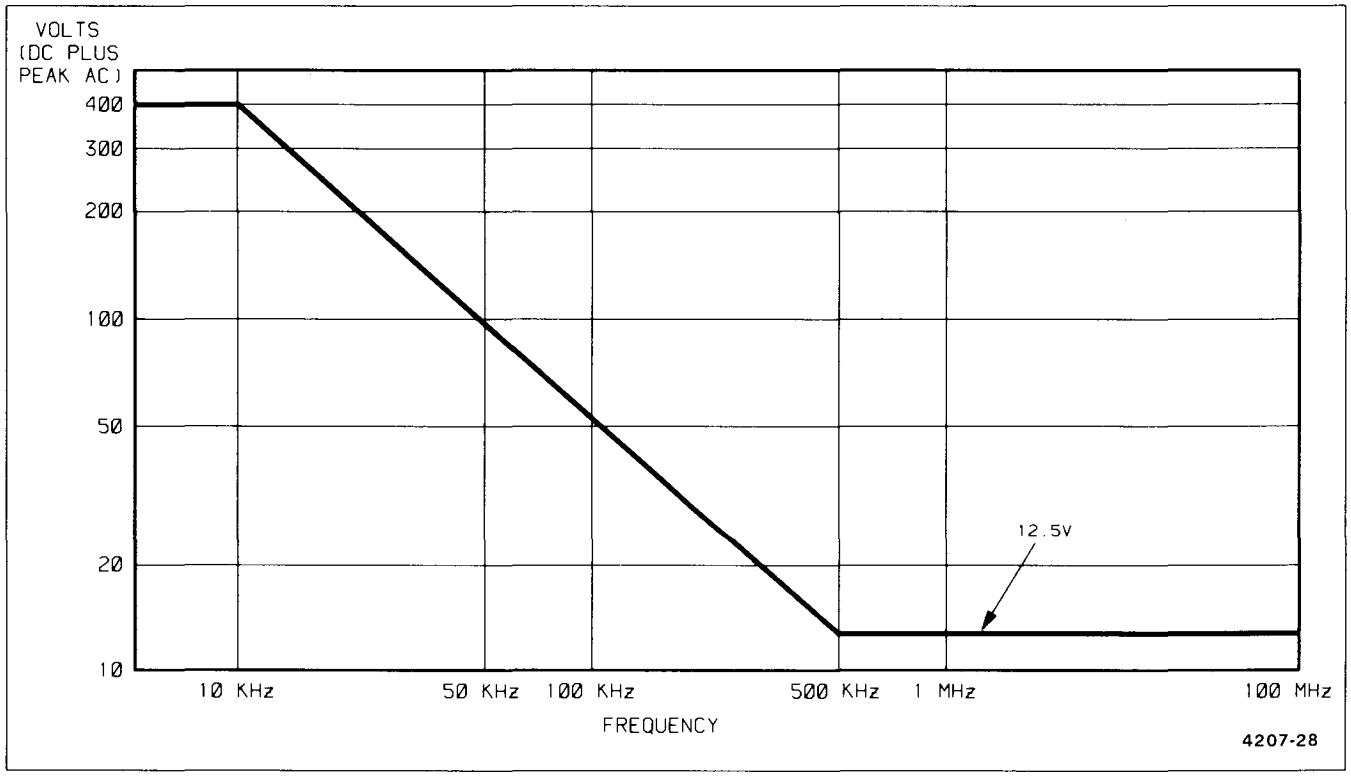


Figure 1-1. Maximum input voltage vs. frequency derating curve for CH 1 OR X, CH 2 OR Y, and EXT INPUT connectors.

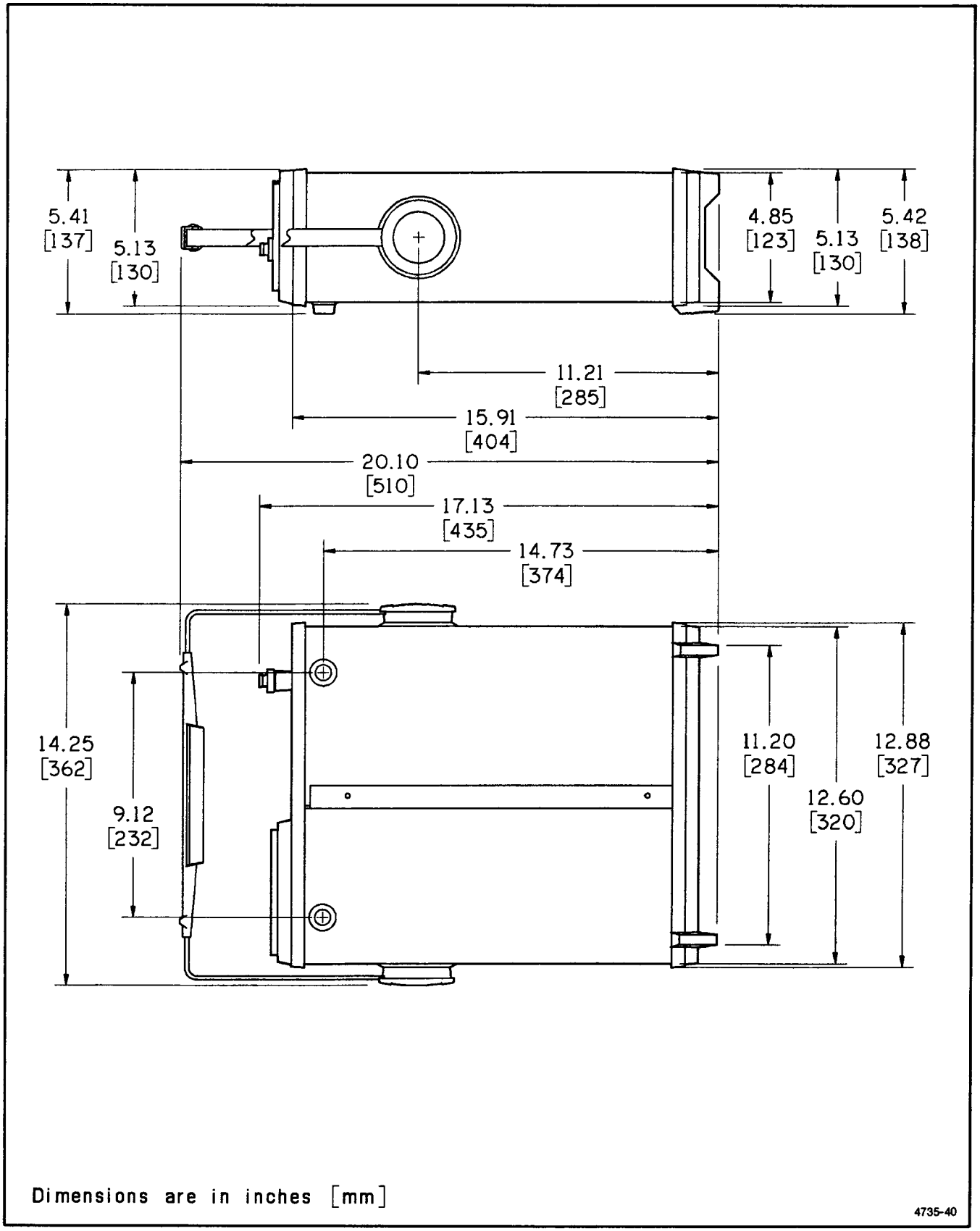


Figure 1-2. Physical dimensions of the 2213A Oscilloscope.

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 2213A. Before connecting the instrument to a power source, carefully read the following about line voltages, power cords, and fuses.

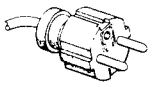
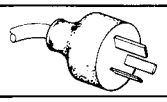
LINE VOLTAGE

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.

Plug Configuration	Usage	Line Voltage	Reference Standards
	North American 120V/ 15A	120V	ANSI C73.11 NEMA 5-15-P IEC 83
	Universal Euro 240V/ 10-16A	240V	CEE (7),II,IV,VII IEC 83
	UK 240V/ 13A	240V	BS 1363 IEC 83
	Australian 240V/ 10A	240V	AS C112
	North American 240V/ 15A	240V	ANSI C73.20 NEMA 6-15-P IEC 83
	Switzerland 220V/ 6A	220V	SEV

Abbreviations:
ANSI — American National Standards Institute
AS — Standards Association of Australia
BS — British Standards Institution
CEE — International Commission on Rules for the Approval of Electrical Equipment
IEC — International Electrotechnical Commission
NEMA — National Electrical Manufacturer's Association
SEV — Schweizevischer Elektrotechischer Verein

(2931-21)4204-53

Figure 2-1. Optional power cords.

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.

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.

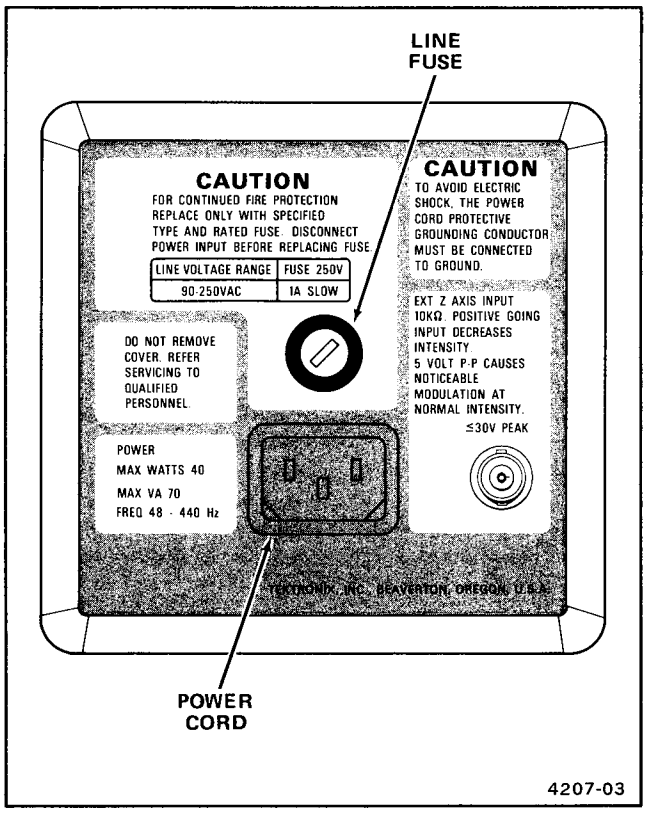


Figure 2-2. Fuse holder and power cord connector.

4. Verify proper fuse value (1.0A, 250 V, slow blow).

5. Reinstall the fuse (or replacement fuse) and the fuseholder 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.

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) **INTENSITY Control**—Determines the brightness of the sweep trace.

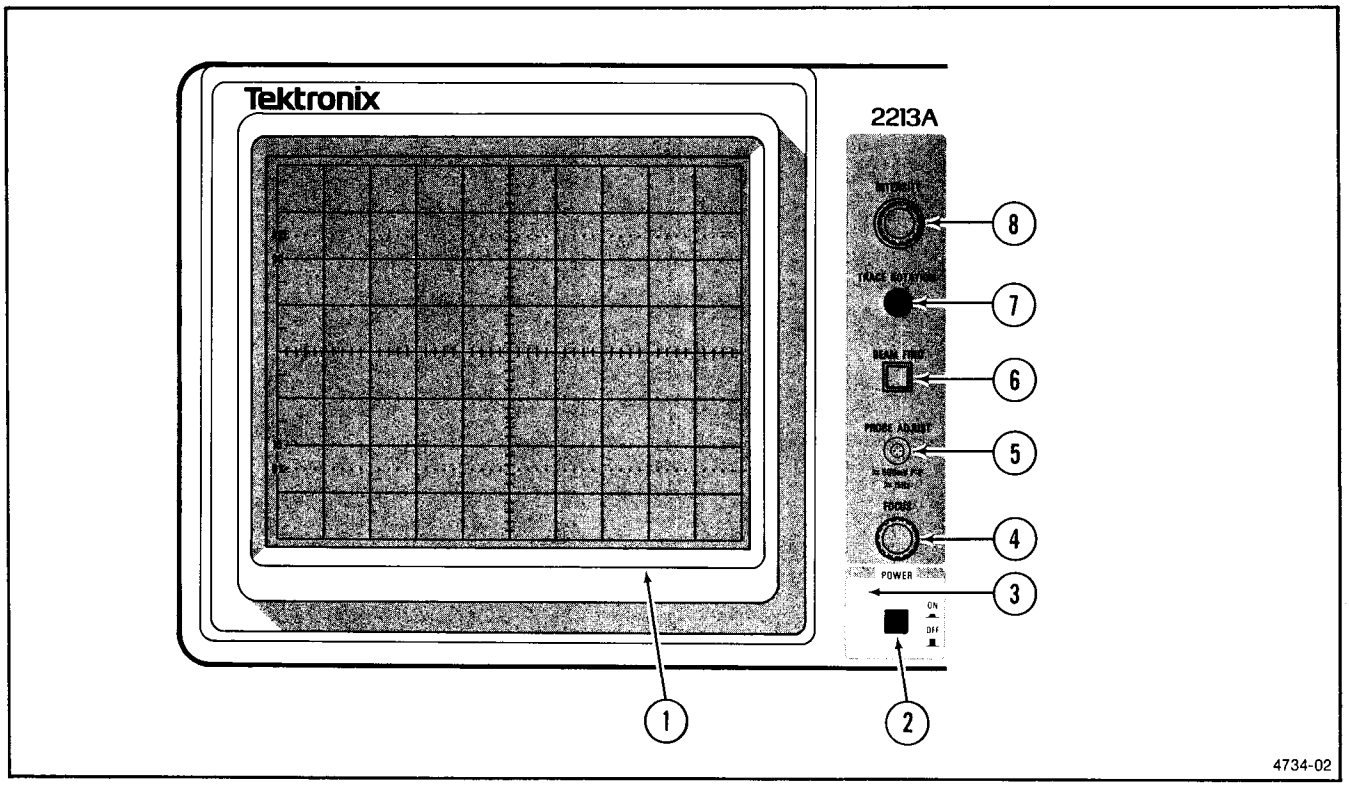


Figure 2-3. Power and display controls and indicators and PROBE ADJUST output.

VERTICAL

Refer to Figure 2-4 for location of items 9 through 16.

(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).

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

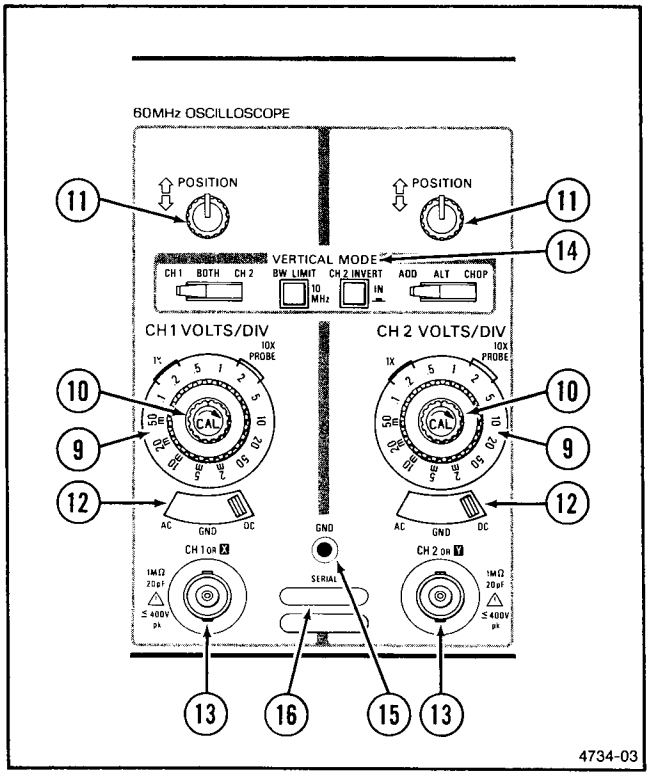


Figure 2-4. Vertical controls and connectors.

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 two button switches 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 μs 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 μs per division.

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

CH 2 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.

(15) **GND Connector**—Provides direct connection to the instrument chassis ground.

(16) **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 17 through 22.

(17) **SEC/DIV Switch**—Used to select the sweep speeds for the sweep generator in a 1-2-5 sequence. To obtain calibrated sweep speeds, the SEC/DIV Variable control must be in the calibrated detent (fully clockwise).

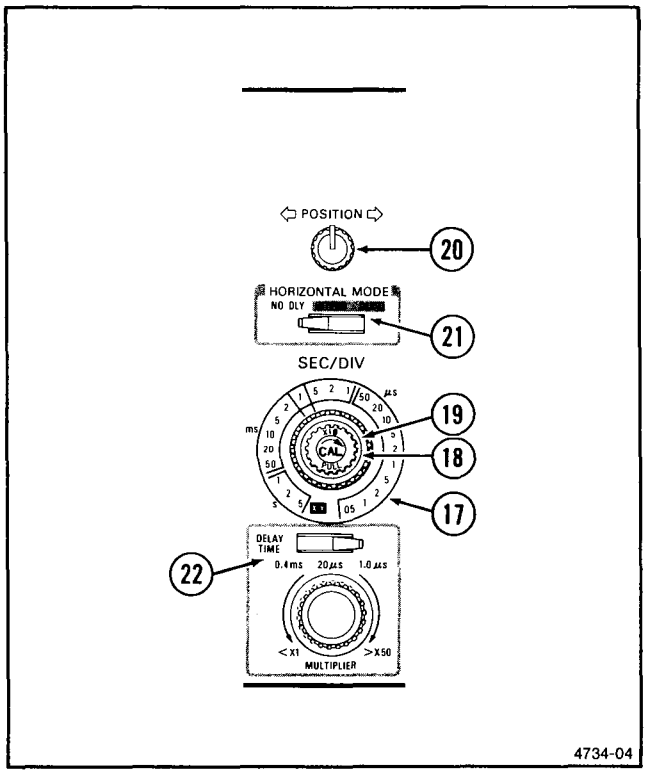


Figure 2-5. Horizontal controls.

(18) **SEC/DIV Variable Control**—Provides continuously variable, uncalibrated 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.

(19) **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.

(20) **POSITION Control**—Positions the display horizontally in all modes.

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

NO DLY—Horizontal deflection is provided by the sweep generator, without a delayed sweep, at a sweep speed determined by the SEC/DIV switch setting.

INTENS—Horizontal deflection is provided by the sweep generator at a sweep speed determined by the SEC/DIV switch. The sweep generator also provides an intensified zone on the display. The start of the intensified zone represents the sweep-start point when DLY'D HORIZONTAL MODE is selected.

DLY'D—Horizontal deflection is provided by the sweep generator at a sweep speed determined by the SEC/DIV switch setting. The start of the sweep is delayed from the initial sweep-trigger point by a time determined by the setting of the DELAY TIME Range Selector switch and MULTIPLIER control.

(22) **DELAY TIME**—Two controls are used in conjunction with INTENS and DLY'D HORIZONTAL MODE to select the amount of delay time between the start of the sweep and the beginning of the intensified zone.

Range Selector Switch—This three-position switch selects 0.4 ms, 20 μs, and 1.0 μs of delay time. To increase the sweep delay from the calibrated setting of the Range Selector Switch, rotate the MULTIPLIER control clockwise.

MULTIPLIER Control—Provides variable sweep delay from less than 1 to greater than 50 times the setting of the Range Selector switch.

TRIGGER

Refer to Figure 2-6 for location of items 23 through 31.

(23) **TRIGGER Mode Switches**—Three-section switch that determines the trigger mode for the sweep.

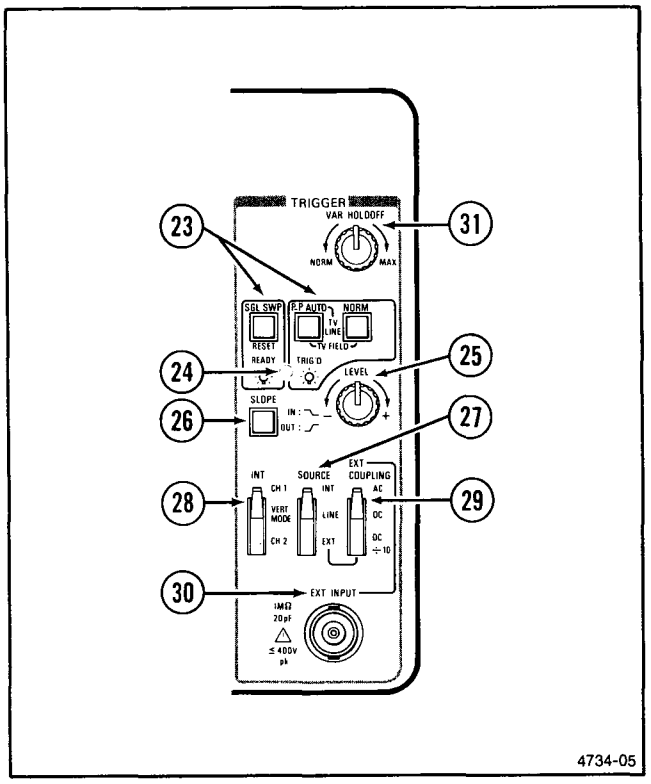


Figure 2-6. Trigger controls, connector, and Indicator.

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

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 rates are below 20 Hz. The range of the TRIGGER LEVEL control is restricted to the peak-to-peak range of the trigger signal.

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.

SGL SWP RESET—Press in the spring-return button momentarily to arm the 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 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).

(24) **TRIG'D-READY Indicator**—LED illuminates when either P-P AUTO or NORM Trigger Mode is selected and the Sweep has been triggered (TRIG'D). In single-sweep display, the LED illuminates to indicate that the Trigger circuit is armed (READY).

(25) **TRIGGER LEVEL Control**—Selects the amplitude point on the trigger signal at which the sweep is triggered.

(26) **SLOPE Switch**—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.

(27) **SOURCE Switch**—Determines the source of the trigger signal that is coupled to the input of the 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 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.

(28) **INT Switch**—Selects the source of the internal triggering signal when the 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.

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

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).

(29) **EXT COUPLING Switch**—Determines the method used to couple external signals to the TRIGGER circuit from the EXT INPUT connector.

AC—Signals above 60 Hz are capacitively coupled to the input of the 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 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 Trigger circuit.

(30) **EXT INPUT Connector**—Provides a means of introducing external signals into the trigger circuit through the EXT COUPLING switch.

(31) **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 32.

(32) **EXT Z-AXIS Connector**—Provides a means of connecting external signals to the Z-Axis amplifier to intensity 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.

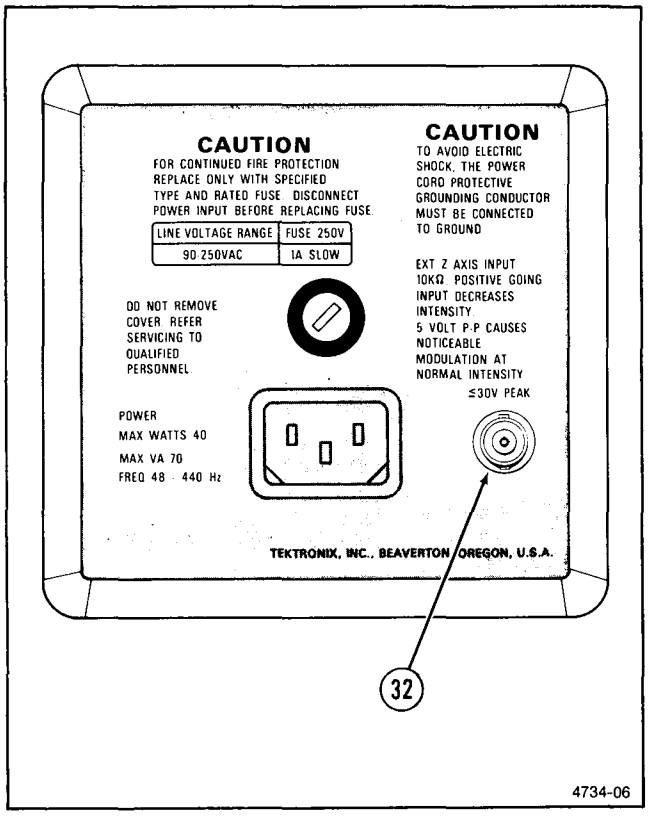


Figure 2-7. Rear-Panel connector.

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 2213A 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

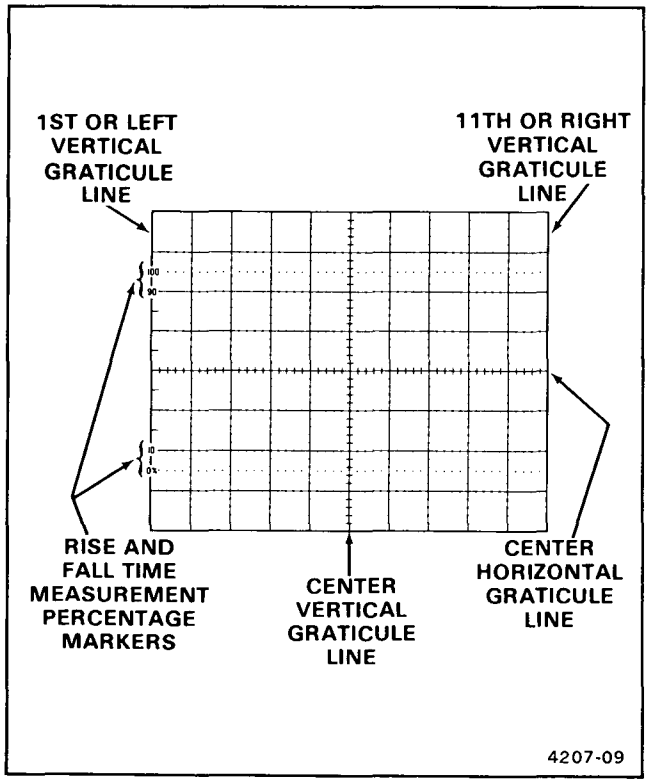


Figure 2-8. Graticule measurement markings.

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.

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-MΩ 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

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
CH 2 INVERT	Off (button out)
Input Coupling	AC

Horizontal

POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	0.5 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
Range Selector	0.4 ms
MULTIPLIER	<X1

Trigger

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT
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 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 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 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.

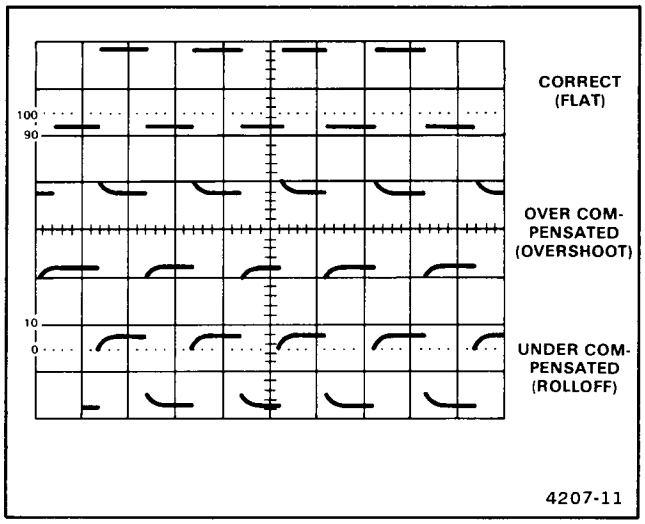


Figure 2-9. Probe compensation.

10. Disconnect the probes from the instrument.

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 2213A 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 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 Sweep Generator. The P-P Auto Trigger circuit ensures that the range of the 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 TRIGGER LEVEL control. In Norm mode, the 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 Sweep Logic circuit controls sweep generation and Z-Axis unblanking for the Sweep display. When the 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 Trigger circuit is disabled until the SGL SWP RESET button is pressed again.

The Sweep Logic circuit controls the operation of the Miller Sweep Generator circuit. The Sweep circuit produces a linear sweep output with a ramp time that is controlled by the 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 HORIZONTAL MODE switch (NO DLY, INTENS, and DLY'D) controls the action of the Delay circuit. This circuit functions to either produce no delay, display an intensified zone on the Sweep display, or to delay the start of the

Sweep for a period of time after receiving a triggering signal. In the INTENS HORIZONTAL MODE, the Delay circuit generates the delay from the trigger event to the beginning of the intensified zone. In the DLY'D HORIZONTAL MODE, the Delay circuit determines the delay from the trigger event to the start of the sweep.

The Z-Axis drive from the Sweep Logic 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.

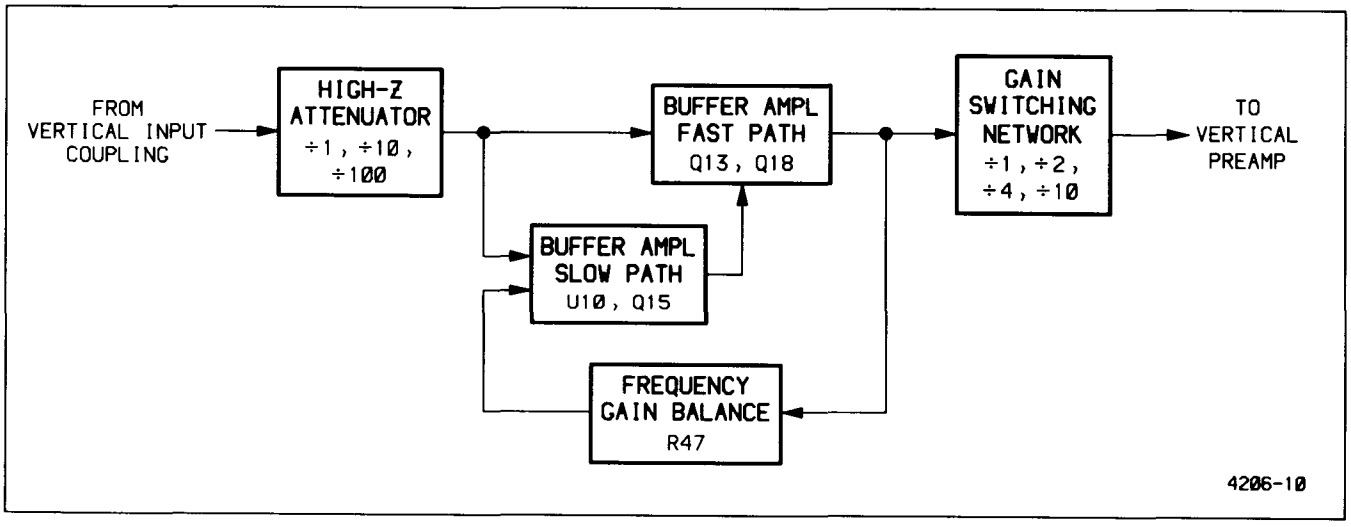


Figure 3-1. Block diagram of the Vertical Attenuators.

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 Ω 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 ÷ 1, ÷ 2, ÷ 4, or ÷ 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 Preamplifier. 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 CH 2 INVERT button is changed between the IN and OUT positions.

VERTICAL PREAMPLIFIERS

The Vertical Preamplifier, 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 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 $\overline{S}$ and $\overline{R}$ inputs of U540A to obtain the various display formats described below.

CHANNEL 1 DISPLAY ONLY. The CH 1 position of S550 grounds the $\overline{S}$ input of U540A while the $\overline{R}$ input is held HI by R539. This will produce a HI and a LO on the Q and $\overline{Q}$ 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.

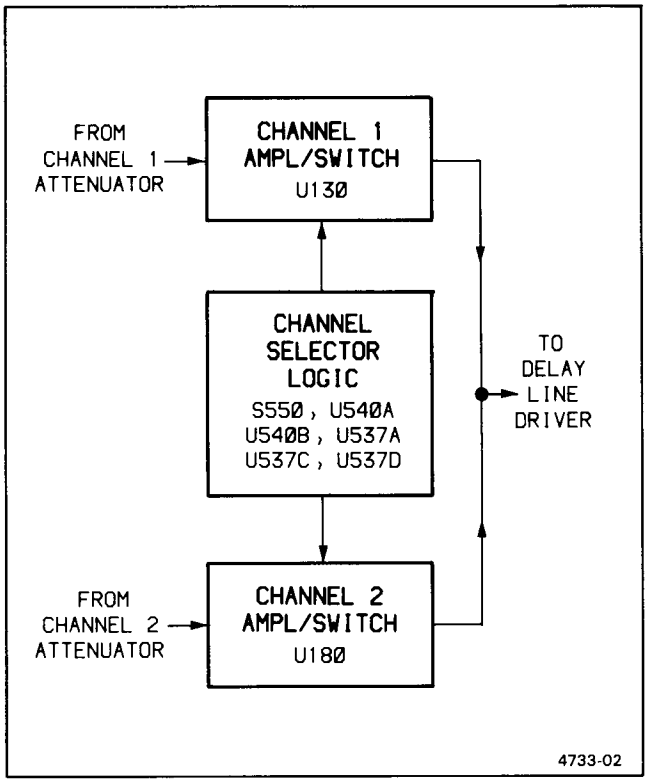


Figure 3-2. Block diagram of the Channel Switching circuitry.

CHANNEL 2 DISPLAY ONLY. The CH 2 position of S550 holds the $\overline{R}$ input of U540A LO through CR538 and the $\overline{S}$ input is held HI by R538. The outputs will then be Q LO and $\overline{Q}$ 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 $\overline{S}$ and $\overline{R}$ inputs of U540A are held LO by CR534 and CR537. The Q and $\overline{Q}$ 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 $\overline{\text{Chop Enable}}$ 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.

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 HI and the Chop Blank signal from U537B will be LO. Input signals to U537A will be the HI from U537C and the Alt Sync signal from the Holdoff circuitry in the 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.

TRIGGER AMPLIFIERS AND SWITCHING

The Trigger Amplifiers, shown on Diagram 3, provide signals to the Trigger Generator circuit from either the Vertical Preamplifiers, the EXT INPUT connector, or the power line. The INT switch selects either Channel 1 or Channel 2 as the trigger source, and the 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 INT switch with the 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 Trigger Generator. Signals from the Internal Trigger Amplifier are passed to the Trigger Generator through forward-biased CR372.

CHANNEL 1. For triggering from Channel 1, the 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 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 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 $\overline{\text{Ch 2 Trig}}$ 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.

The CHOP VERTICAL MODE position grounds the $\overline{\text{V Mode T}}$ 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 Trigger Generator.

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, and the base of U350B. The emitter signal of U350B in turn drives the Trigger Generator whenever CR372 is forward biased.

External Trigger Amplifier

The External Trigger Amplifier buffers signals applied to the EXT INPUT connector to drive the Trigger Generator. Input signal coupling is determined by EXT COUPLING switch S380 which selects AC, DC, or DC ÷ 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 ÷ 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 Trigger Generator through forward-biased CR393 whenever the SOURCE switch is set to EXT. When the 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 Trigger Generator when the 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 Trigger Generator.

TRIGGER GENERATOR

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

Trigger Level Circuit

The Trigger Level Circuit establishes voltages at the ends of the TRIGGER LEVEL potentiometer as a function of the TRIGGER push button selection and trigger signals selected by the 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 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 Trigger Level circuit. The inputs and outputs of U426A and U426B will then be fixed voltages and independent of trigger-signal amplitude.

Trigger Level Comparator

The Trigger Level Comparator compares signals selected by the TRIGGER SOURCE switch to a voltage set by the TRIGGER LEVEL control. Positive or negative slope triggering is selected by the TRIGGER SLOPE switch.

Transistors U460B and U460E compare the wiper voltage on the 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 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.

Schmitt Trigger and TV Trigger Circuit

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

The output signals from the 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 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 Trigger signal output will be the inverse of the filtered signal appearing at U480B pin 7.

SWEEP GENERATOR AND LOGIC

The Sweep Generator and Logic circuitry, shown on Diagrams 4 and 5, 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 Sweep Generator and Logic circuitry.

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.

Miller Sweep Generator

The 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 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.

The 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 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 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 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.

Sweep Logic

The Sweep Logic circuitry controls sweep generation, as a function of incoming trigger signals and the 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

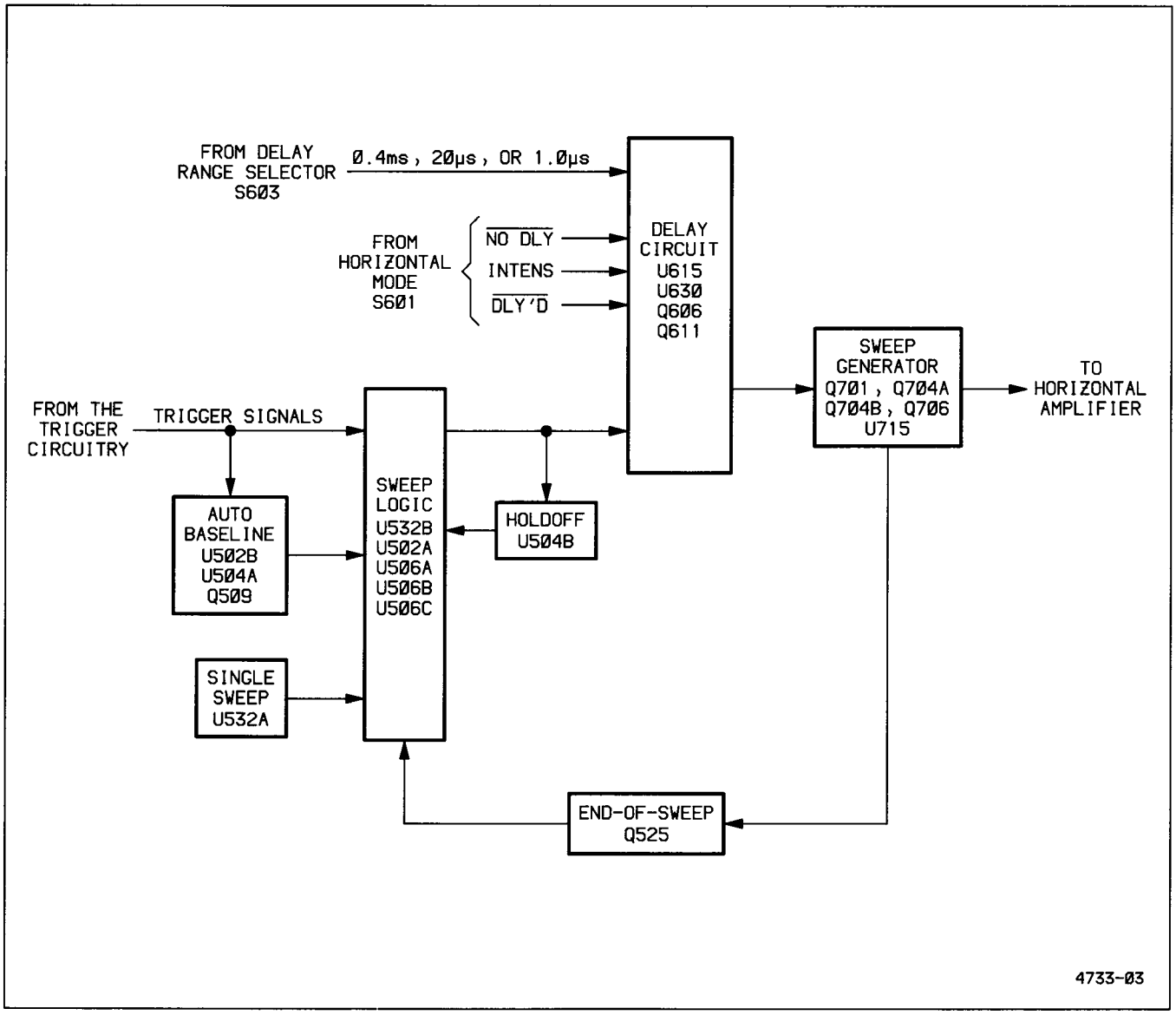


Figure 3-3. Block diagram of the Sweep Generator and Logic circuitry.

LO. Whenever trigger signals are being received, the $\overline{Q}$ 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.

At the beginning of the holdoff period, pin 2 of U506A is set HI by U532B. This sets pins 3 and 4 of U630 LO, forcing pin 6 of U630 HI and holding the Miller Sweep in a reset condition. At the end of holdoff, pin 5 of U506A goes LO enabling the next trigger signal to clock the LO on the D input through to the output. The LO on pin 2 of U506A forces pin 6 of U630 LO allowing the Miller Sweep to generate the sweep ramp as described in the "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 thus triggering holdoff one-shot U504B and forcing pin 6 of U630 HI. This starts holdoff, and resets the Miller Sweep which turns off Q525.

With U504B triggered, the $\overline{Q}$ output changes from HI to LO and will stay LO for a time duration determined by the Var Holdoff circuitry and the 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 $\overline{Q}$ 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 $\overline{Q}$ output goes HI to end the holdoff period and release 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 $\overline{Q}$ output LO and the sweep disabled. When the SGL SWP button is pushed in, the $\overline{Q}$ 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 $\overline{XY}$ 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.

Delay Circuit

The delay circuit, composed of Q606, Q611, U615, U630, and associated components, generates the timing and gates signals required to produce the Intensified Sweep display and to provide the variable Sweep delay. HORIZONTAL MODE switch S601 controls the display mode (NO DLY, INTENS, or DLY'D), and Range Selector switch S603 selects the basic delay time. The DELAY TIME MULTIPLIER control (R9615) increases the possible delay available by up to at least fifty times the basic delay.

NO DLY. With HORIZONTAL MODE switch S601 set to the NO DLY, U630 pin 2 is held HI. The sweep start is controlled by the signal on pin 3 of U630. When a trigger occurs, pin 2 of U630 goes HI causing pin 6 of U630 to go LO and the Miller Sweep starts.

The $\overline{\text{No Dly}}$ line is also pulled LO disabling the delayed comparator U615 so it does not fire during the sweep.

INTENS. With S601 set to the INTENS position pin 2 of U630 is held HI and the sweep starts in the same manner as in NO DLY HORIZONTAL MODE. The trigger that starts the sweep also starts the delay circuit by forcing the base of Q606 LO.

The delay is determined by comparing the variable voltage from the Multiplier control R9615 with the delay voltage ramp. The delay voltage ramp is generated from a Miller integrator composed of Q611, R611, and timing components R606, R607, C606, and C607. The timing components are switched by S603 to select the different delays.

When the signal at the collector of Q576 is HI, Q606 is turned on, discharging C606 and C607 and holding the ramp output LO. When the trigger occurs, Q606 is turned off and the timing capacitors charge at a rate determined by the timing resistors. When the ramp voltage exceeds the comparision voltage, the output of the delayed comparator U615 goes HI, forcing pin 9 of U630 HI. Since pin 10 of U630 is held HI in the Intensified Mode, pin 8 of U630 is forced LO at the end of delay.

The Low Voltage on pin 8 of U630 allows CR821 to conduct, thus increasing the Z-Axis drive and display intensity. The non-intensified portion of the trace indicates the amount of total delay time.

DLY'D. In this position of the HORIZONTAL MODE switch S601, the start of the sweep is delayed by the amount of time established by the Delay circuit. In this mode the pins 2 and 10 of U630 are held LO disabling the non-delayed sweep and the intensified display. When the trigger occurs, U630 pin 4 goes HI enabling the delay and comparator to determine the sweep start. At the end of delay, U615 pin 7 goes HI, forcing U630 pin 6 LO. The LO at pin 6 initiates the sweep.

HORIZONTAL

The Horizontal Amplifier circuit, shown on Diagram 5, provides the output signals that drive the horizontal crt deflection plates. Signals applied to the Horizontal Preamplifier can come from either the Miller Sweep Generator (for sweep deflection) or from the XY Amplifier (when X-Y display mode is selected). 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 Preamplifier

The Horizontal Preamplifier amplifies input signals for application to the Horizontal Output Amplifier.

The preamplifier is a cascode differential pair. The horizontal X10 gain is set by the resistor network connected between pins 10 and 7 of U745. When the X10 Magnifier is on, S721 is closed and the timing adjustment is made using R748. Magnifier registration is adjusted by R753 so that there is no horizontal trace shift when switching between the X10 Magnifier on and off positions. The horizontal position signal from R726 is buffered by Q728 and is applied to one side of the amplifier. The horizontal position is adjusted with this control in both the sweep and X-Y modes.

X-Y Amplifier

In the X-Y mode of operation the $\overline{XY}$ line is LO, biasing Q732 in the linear region. Q732 and Q737 are a transconductance amplifier which changes an input voltage to output current. The input signal is applied through gain adjust R731. The X-Axis Offset adjustment is R738. The signal current flowing out of Q737 is fed into the shunt feedback stage consisting of Q742, Q743, R742, R743, and R744. The output of the shunt feedback stage drives the preamplifier in all horizontal modes. The sweep is held at a constant low output level when in X-Y mode.

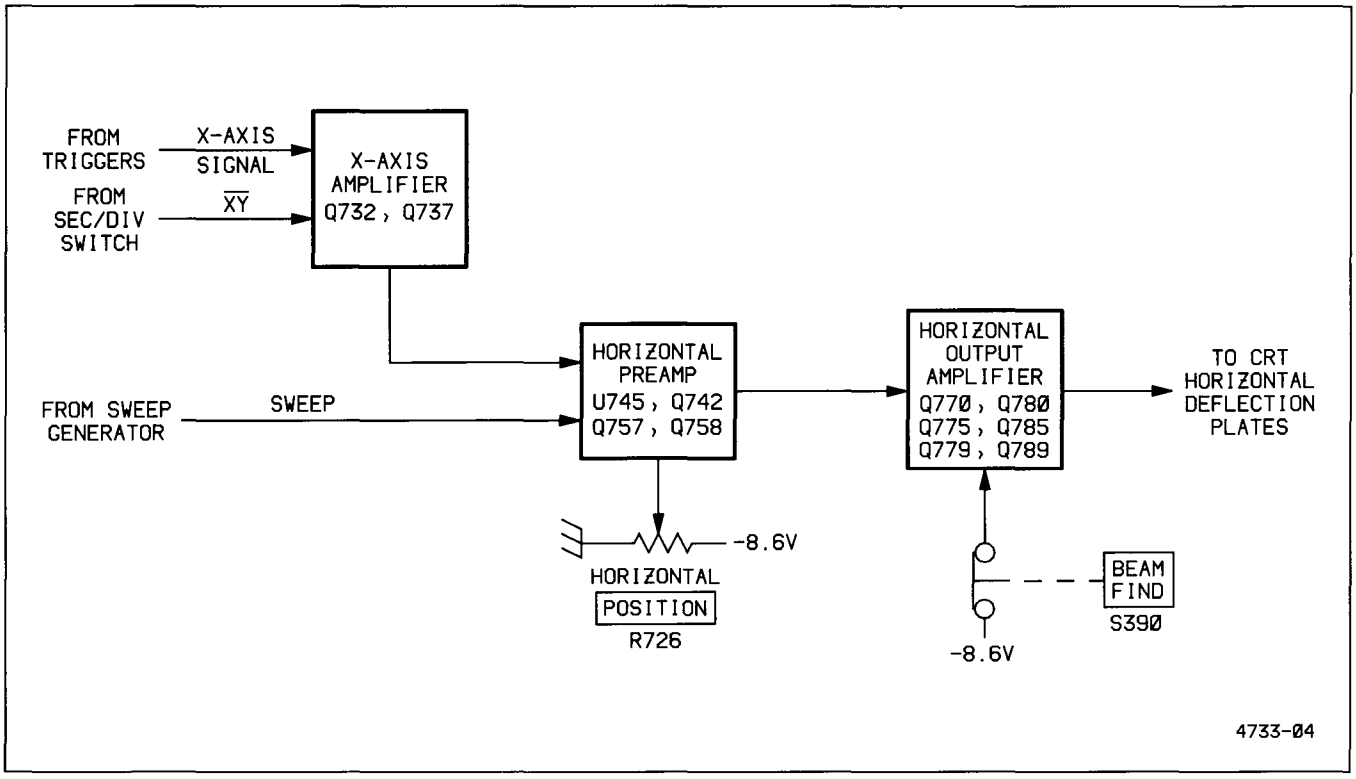


Figure 3-4. Block diagram of the Horizontal Amplifier.

When in the sweep mode, the $\overline{XY}$ line is high and biases Q732 off which in turn biases Q737 off and disables the XY amplifier.

The $\overline{XY}$ line also turns on Q739 thereby not allowing the X axis signal to get to the amplifier. The sweep signal is applied through the gain setting resistor (R740) and R741 to the shunt feedback stage. The output of the shunt feedback stage drives the preamplifier.

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 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 NO DLY, INTENS, DLY'D HORIZONTAL MODE is determined by the INTENSITY control and associated circuitry. The 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.

When the sweep is displayed, CR583 is reverse biased allowing the current through R818 to flow through CR818 and turn on the Z-Axis. When the Intensified Zone is to be displayed, CR630 and CR580 are reverse biased adding to the Z-Axis drive.

When X-Y is displayed CR583, CR580, and CR630 are all forward biased and CR551 is reverse biased allowing the intensity to be set by the current through CR820.

When CHOP VERTICAL MODE is selected, the Chop Blank signal is applied to the collector of Q825 through CR824 during the display-switching time. Diode CR825 is reverse biased 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.

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 of 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 the Z-Drive signals, or the setting of the INTENSITY control. A bright trace or dot will then be displayed.

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 ±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.

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.

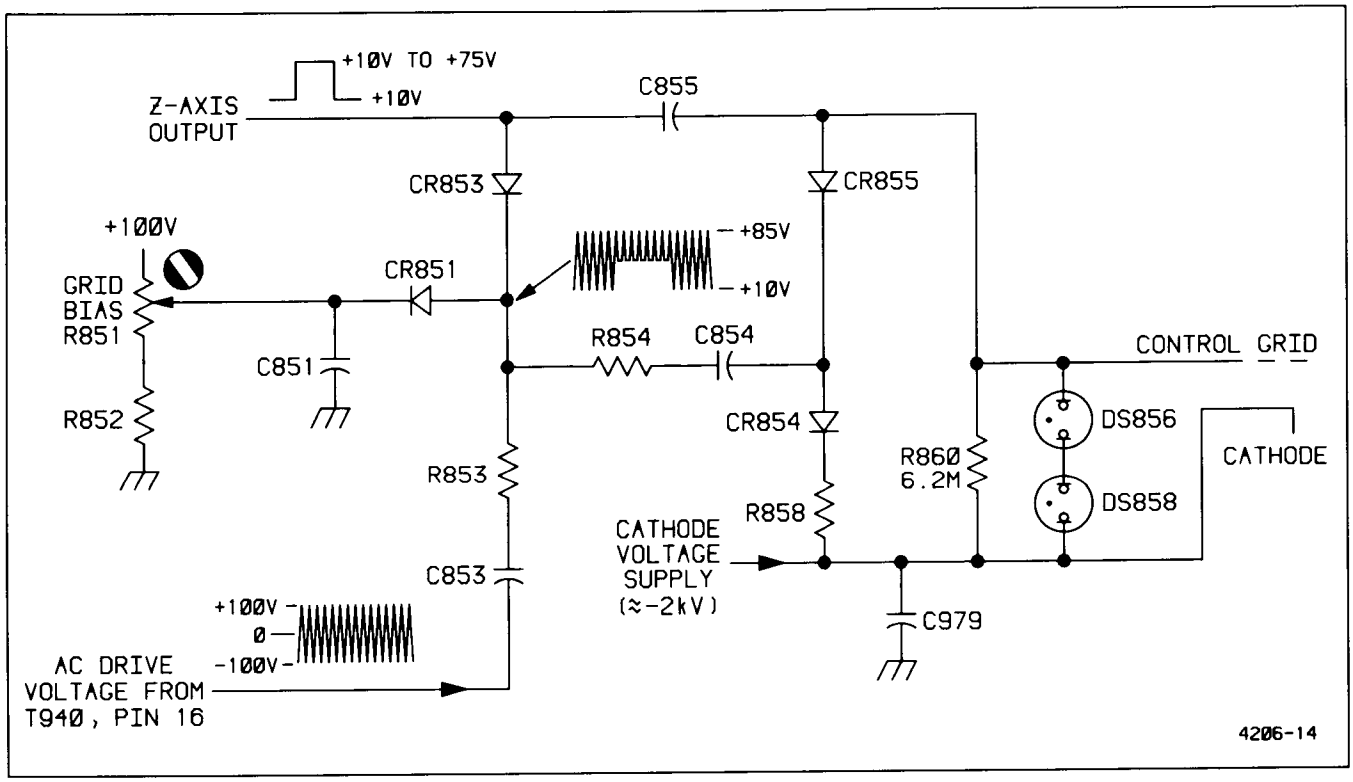


Figure 3-5. Simplified diagram of the Dc Restorer circuitry.

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.

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. 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 −2kV 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 intensity level through the action of Q885. The emitter voltage of Q804, set by the 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. Accuracy: ±0.3%. High-amplitude signal levels: 1 V to 60 V. Repetition rate: 1 kHz. Fast-rise signal level: 1V. Repetition rate: 1 MHz. Rise time: 1 ns or less. Flatness: ±0.5%.	Vertical and horizontal checks and adjustments.	TEKTRONIX PG 506 Calibration Generator.[a]
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 Ω. Reference frequency: 50 kHz. Amplitude accuracy: constant within 3% of reference frequency as output frequency changes.	Vertical, horizontal, and triggering checks and adjustments. Display adjustment and Z-Axis check.	TEKTRONIX SG 503 Leveled Sine-Wave Generator.[a]
3. Time-Mark Generator	Marker outputs: 10 ns to 0.5 s. Marker accuracy: ±0.1%. Trigger output: 1 ms to 0.1 μs, time-coincident with markers.	Horizontal checks and adjustments. Display adjustment.	TEKTRONIX TG 501 Time-Mark Generator.[a]
4. Cable (2 required)	Impedance: 50 Ω. Length: 42 in. Connectors: BNC.	Signal interconnection.	Tektronix Part Number 012-0057-01.
5. Termination (2 required)	Impedance: 50 Ω. Connectors: BNC.	Signal termination.	Tektronix Part Number 011-0049-01.

[a]**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.[a]
11. Test Oscilloscope with included 10X Probe	Bandwidth: ḍc 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.	Triplett 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.

[a]Requires a TM 500-series power-module mainframe.

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VERTICAL

Equipment Required (see Table 4-1):

- Calibration Generator (Item 1)
- Leveled Sine-Wave Generator (Item 2)
- 50-Ω BNC Cable (Item 4)
- 50-Ω BNC Termination (Item 5)
- Dual-Input Coupler (Item 6)
- 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
CH 2 INVERT	Off (button out)
Input Coupling	DC

Horizontal

POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	0.2 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT
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:

BW LIMIT	Off (button out)
VOLTS/DIV (both)	2 mV
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 Switch Setting	Generator 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
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
CH 2 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.

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
CH 2 INVERT	Off (button out)
Channel 2 Input Coupling	GND
SEC/DIV	0.1 μs

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 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)
- Leveled Sine-Wave Generator (Item 2)
- Time-Mark Generator (Item 3)
- 50 Ω BNC Cable (Item 4)
- 50 Ω BNC Termination (Item 5)

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	NO DLY
SEC/DIV	0.05 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
Range Selector	10 μs
MULTIPLIER	<X1

TRIGGER

VAR HOLDOFF	NORM
Mode	NORM
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT
EXT COUPLING	DC ÷ 10

PROCEDURE STEPS

1. Check Timing Accuracy and Linearity

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

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

c. Adjust the 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 Switch Setting	Time-Mark Generator Setting	
	Normal	X10 Magnified
0.05 μs	50 ns	10 ns
0.1 μs	0.1 μs	10 ns
0.2 μs	0.2 μs	20 ns
0.5 μs	0.5 μs	50 ns
1 μs	1 μs	0.1 μs
2 μs	2 μs	0.2 μs
5 μs	5 μs	0.5 μs
10 μs	10 μs	1 μs
20 μs	20 μs	2 μs
50 μs	50 μs	5 μs
0.1 ms	0.1 ms	10 μs
0.2 ms	0.2 ms	20 μs
0.5 ms	0.5 ms	50 μs
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
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 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 SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "Normal" column.

g. Set:

SEC/DIV	0.05 μs
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 SEC/DIV and time-mark generator setting combinations shown in Table 4-4 under the "X10 Magnified" column.

2. Check Variable Range

a. Set:

HORIZONTAL MODE	NO DLY
SEC/DIV	0.2 ms
SEC/DIV Variable	Fully counterclockwise
X10 Magnifier	Off (knob in)
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 Range

a. Set:

Channel 1 Input Coupling	GND
SEC/DIV Variable	CAL (detent)
HORIZONTAL MODE	INTENS
MULTIPLIER	<X1

b. CHECK—Each Range Selector switch and SEC/DIV switch combination under "MULTIPLIER <X1" in Table 4-5 produces a nonintensified display of length shown in the "Display Length" column.

c. Rotate the MULTIPLIER control to >X50.

d. CHECK—Each Range Selector switch and SEC/DIV switch combination under "MULTIPLIER >X50" in Table 4-5 produces a nonintensified display of length shown in the "Display Length" column.

Table 4-5
Delay Time Range Checks

	MULTIPLIER <X1		MULTIPLIER >X50	
Range Selector Setting	SEC/DIV Setting	Display Length (Divisions)	SEC/DIV Setting	Display Length (Divisions)
1 μs	200 ns	<5	10 μs	>5
20 μs	5 μs	<4	0.2 ms	>5
0.4 ms	0.1 ms	<4	5 ms	>4

4. Check Delay Time Jitter

a. Set:

CH 1 VOLTS/DIV	0.5 V
Channel 1 Input Coupling	DC
SEC/DIV	0.1 ms
Range Selector	20 μs
MULTIPLIER	>X50

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

c. Align the 1st time marker with the 1st graticule line. Adjust the MULTIPLIER control so that the intensified sweep starts on the 11th time marker to produce a 1 ms delay.

d. Set the SEC/DIV switch to 0.1 μs and set the HORIZONTAL MODE switch to DLY'D. Adjust the MULTIPLIER control slightly to bring the leading edge of the time marker within the graticule area, if it is not already visible.

e. CHECK—Jitter on the leading edge of the time marker does not exceed 1.0 division. Disregard slow drift.

5. Check Position Range

a. Set:

HORIZONTAL MODE	NO DLY
SEC/DIV	10 μs

b. Select 10 μs 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 μs 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
SEC/DIV	X-Y
X10 Magnifier	Off (knob in)

b. Connect the standard-amplitude generator output via a 50 Ω 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 Ω cable and a 50 Ω 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.

TRIGGER

Equipment Required (see Table 4-1):

Leveled Sine-Wave Generator (Item 2)	50 Ω BNC Termination (Item 5)
50 Ω BNC Cable (Item 4)	Dual-Input Coupler (Item 6)

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
CH 2 INVERT	Off (button out)
Input Coupling (both)	DC

Horizontal

POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	0.2 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
Range Selector	1.0 μs
MULTIPLIER	<X1

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT
EXT COUPLING	DC

PROCEDURE STEPS

1. Check Internal Triggering

a. 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.

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 TRIGGER LEVEL control for each switch combination given in Table 4-6.

Table 4-6
Switch Combinations for Triggering Checks

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

e. Set the VERTICAL MODE switch to CH 2.

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

g. Repeat part d.

h. Set:

SEC/DIV	0.1 μs
X10 Magnifier	On (knob out)

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

j. Repeat part d.

k. Set the VERTICAL MODE switch to CH 1.

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

m. Repeat part d.

2. Check External Triggering

a. Set:

VERTICAL MODE	CH 1
CH 1 VOLTS/DIV	20 mV
HORIZONTAL MODE	NO DLY
SEC/DIV	0.1 μs
X10 Magnifier	Off (knob in)
SOURCE	EXT

b. Connect the leveled sine-wave generator output via a 50 Ω cable, a 50 Ω 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 TRIGGER LEVEL control for each switch combination given in Table 4-6.

e. Set the 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
SEC/DIV	20 μs
X10 Magnifier	Off (knob in)
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 TRIGGER LEVEL control is rotated.

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

e. Set the TRIGGER SLOPE button to IN.

f. CHECK—Display is triggered along the entire negative slope of the waveform as the 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 TRIGGER LEVEL control to obtain a stable display.

b. Set:

Channel 1 Input Coupling	GND
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 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)
- Two 50 Ω BNC Cables (Item 4)
- 50 Ω BNC Termination (Item 5)
- BNC T-Connector (Item 8)
- 10X Probe (provided with instrument)

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	NO DLY
SEC/DIV	20 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT

PROCEDURE STEPS

1. Check External Z-Axis Operation

a. Connect the leveled sine-wave generator output via a 50 Ω cable and a T-connector to the CH 1 OR X input connector. Then connect a 50 Ω cable and a 50 Ω 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
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.

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 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.

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-

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 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

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 START	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								■	■											
HORIZ GAIN										■	■			■	■					
HORIZ X10 GAIN										■	■			■	■					
HIGH-SPEED TIMING														■	■					
TRIGGER OFFSET																■		■	■	
TRIGGER SENSITIVITY																	■	■		
SLOPE BALANCE																	■	■		
CRT REPLACEMENT	■	■				■		■	■	■	■	■	■	■	■		■	■		

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POWER SUPPLY AND CRT DISPLAY

Equipment Required (See Table 4-1):

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

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	NO DLY
SEC/DIV	X-Y
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT

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.

a. Connect the digital voltmeter low lead to chassis ground and connect the volts lead to the −8.6 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

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 Ω 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 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 Ω termination from the EXT Z AXIS INPUT connector.

4. Adjust Astigmatism (R874)

a. Set:

INTENSITY	Visible display
Channel 1 Input Coupling	DC
SEC/DIV	5 μs

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, 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 CH 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
Channel 1 Input Coupling	DC
SEC/DIV	0.1 ms

b. Connect 20 μs time markers from the time-mark generator via a 50 Ω cable and a 50 Ω 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 c 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
CH 2 INVERT	Off (button out)
Input Coupling	GND

Horizontal

POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	0.5 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT
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 CH 2 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 CH 2 INVERT button to Off (button out).

f. Repeat parts b through e until there is no trace shift when switching the CH 2 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
SEC/DIV	20 μs

b. Connect the high-amplitude square wave output via a 50 Ω cable, a 10X attenuator, and a 50 Ω 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.

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 Ω cable to the CH 1 OR X input connector.

b. Set the 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	3.88 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
SEC/DIV	20 μs

b. Connect the high-amplitude square wave output via a 50 Ω cable and a 50 Ω 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.

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

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

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

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

h. Replace the 50 Ω cable and 50 Ω termination with the 10X probe (supplied with the instrument).

i. Set the CH 1 VOLTS/DIV switch to 10 mV and the 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 the 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.

s. Repeat parts b 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
SEC/DIV	50 ms
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 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
SEC/DIV	1 μs
INT	VERT MODE
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 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
SEC/DIV	0.05 μs
SOURCE	INT

b. Connect the positive-going fast-rise square wave output via a 50 Ω cable, a 10X attenuator, and a 50 Ω 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 ±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 POSITION (both)	Midrange
BW LIMIT	On (button in)
VOLTS/DIV Variable (both)	CAL detent
Input Coupling (both)	DC
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 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.

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.

Table 5-5
Settings for Bandwidth Checks

VOLTS/DIV Switch Setting	Generator Output Frequency
2 mV	50 MHz
5 mV to 5 V	60 MHz

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
SEC/DIV	0.1 μs

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

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 Ω cable, a 50 Ω 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 Ω BNC Termination (Item 5)
Leveled Sine-Wave Generator (Item 2)	Test Oscilloscope (Item 11)
Time-Mark Generator (Item 3)	Screwdriver (Item 13)
50 Ω 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	NO DLY
SEC/DIV	0.1 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
Range Selector	1.0 μs
MULTIPLIER	<X1

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT

PROCEDURE STEPS

1. Adjust Horizontal Amplifier Gain (R740)

a. Connect 0.1 ms time markers from the time-mark generator via a 50 Ω cable and a 50 Ω 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—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.

2. Adjust Magnifier Registration (R753)

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 (R753) 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.

3. Adjust X10 Horizontal Amplifier Gain (R748)

a. Set the x10 Magnifier to On (knob out).

b. Select 10-μs 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 (R748) for 1 time marker per division over the center 8 divisions.

4. Check Position Range

a. Set:

Channel 1 Input Coupling	DC
SEC/DIV	10 μs

b. Select 10-μs 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 μs 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
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 High-Speed Timing (C703)

a. Set:

HORIZONTAL MODE	NO DLY
SEC/DIV	0.1 μs

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

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

7. Adjust 5 ns Timing and Linearity (C775)

a. Set:

CH 1 VOLTS/DIV	0.2 V
HORIZONTAL MODE	NO DLY
SEC/DIV	0.05 μs
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 linearity should be made by readjusting the 5-ns Timing capacitor (C775).

8. Check Timing Accuracy and Linearity

a. Set:

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

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

c. Adjust the 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 Switch Setting	Time-Mark Generator Setting	
	Normal	X10 Magnified
0.05 μs	50 ns	10 ns
0.1 μs	0.1 μs	10 ns
0.2 μs	0.2 μs	20 ns
0.5 μs	0.5 μs	50 ns
1 μs	1 μs	0.1 μs
2 μs	2 μs	0.2 μs
5 μs	5 μs	0.5 μs
10 μs	10 μs	1 μs
20 μs	20 μs	2 μs
50 μs	50 μs	5 μs
0.1 ms	0.1 ms	10 μs
0.2 ms	0.2 ms	20 μs
0.5 ms	0.5 ms	50 μs
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
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 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 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) and select 50 ms time markers from the time-mark generator.

h. 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.

i. 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.

j. Repeat parts h and i for the remaining SEC/DIV and time-mark generator setting combinations shown in Table 5-6 under the "X10 Magnified" column.

9. Adjust Delay Start (R617)

a. Set:

HORIZONTAL MODE	INTENS
SEC/DIV	0.1 μs
SEC/DIV Variable	CAL detent
Range Selector	1.0 μs
MULTIPLIER	<X1

b. Select 100 ns time markers from the time-mark generator.

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

d. Ensure that the MULTIPLIER control is in <X1 position (extreme counterclockwise).

e. ADJUST—Delay Start (R617) so that the intensified zone starts at the 8th time marker (700 ns delay).

10. Check Delay Time Range

a. Set:

Channel 1 Input Coupling	GND
SEC/DIV Variable	CAL (detent)
HORIZONTAL MODE	INTENS
Multiplier	<X1

b. CHECK—Each Range Selector switch and SEC/DIV switch combination under "MULTIPLIER <X1" in Table 5-7 produces a nonintensified display of length shown in the "Display Length" column.

c. Rotate the MULTIPLIER control to >X50.

d. CHECK—Each Range Selector switch and SEC/DIV switch combination under "MULTIPLIER >X50" in Table 5-7 produces a nonintensified display of length shown in the "Display Length" column.

Table 5-7
Delay Time Range Checks

	MULTIPLIER <X1		MULTIPLIER >X50	
Range Selector Setting	SEC/DIV Setting	Display Length (Divisions)	SEC/DIV Setting	Display Length (Divisions)
1 μs	200 ns	<5	10 μs	>5
20 μs	5 μs	<4	0.2 ms	>5
0.4 ms	0.1 ms	<4	5 ms	>4

11. Check Delay Time Jitter

a. Set:

CH 1 VOLTS/DIV	0.5 V
Channel 1 Input Coupling	DC
SEC/DIV	0.1 ms
Range Selector	20 μs
MULTIPLIER	>X50

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

c. Align the 1st time marker with the 1st graticule line. Adjust the MULTIPLIER control so that the intensified sweep starts on the 11th time marker to produce a 1-ms delay.

d. Set the SEC/DIV switch to 0.1 μs and set the HORIZONTAL MODE switch to DLY'D. Adjust the MULTIPLIER control slightly to bring the leading edge of the time marker within the graticule area, if it is not already visible.

e. CHECK—Jitter on the leading edge of the time marker does not exceed 1.0 division. Disregard slow drift.

12. Adjust X Gain (R731)

NOTE

The Trigger Offset adjustment affects the X Gain circuitry and needs to be adjusted before the X Gain.

a. ADJUST—Trigger Offset (Step 1) in the Trigger section of the "Adjustment Procedure".

b. Set:

CH 1 VOLTS/DIV	10 mV
SEC/DIV	X-Y

c. Connect a 50 mV standard-amplitude signal via a 50 Ω cable to the CH 1 OR X input connector.

d. ADJUST—X Gain (R731) for exactly 5 divisions of horizontal deflection.

13. Adjust X Offset (R738)

a. Set:

Channel 1 Input Coupling	GND
SEC/DIV	1 ms

b. Position the trace vertically to the center horizontal graticule line.

c. Position the trace horizontally so the start of the trace begins at the first vertical graticule line (extreme left).

d. Set the SEC/DIV switch to X-Y mode. Do not change the setting of the Horizontal POSITION control.

e. ADJUST—X Offset (R738) to position the dot at the seventh vertical graticule line (sixth division to the right).

f. INTERACTION—Recheck parts b through d of Step 12 of this procedure.

14. Check X Bandwidth

a. 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.

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.

15. Check Sweep Holdoff

a. Set:

HORIZONTAL MODE	NO DLY
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 Sweep holdoff is greater then 3 ms but less than 7 ms.

d. Rotate the VAR HOLDOFF control to the maximum clockwise position (MAX).

e. CHECK—The 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)
- 50 Ω BNC Cable (Item 4)
- 50 Ω BNC Termination (Item 5)
- Dual-Input Coupler (Item 6)
- 10X Attenuator (Item 7)
- Digital Voltmeter (Item 12)
- Screwdriver (Item 13)

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
CH 2 INVERT	Off (button out)
Input Coupling	GND

Horizontal

POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	1 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	CH 2
SOURCE	INT
EXT COUPLING	DC

PROCEDURE STEPS

1. Adjust Trigger Offset (R309)

NOTE

If the Trigger Offset was adjusted in the Horizontal section, proceed to Step 2 of this section.

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 TP350.

c. CHECK—The offset voltage reading is less than 80 mV. Note the reading for use in part e.

d. Set the 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 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 INT switch.

h. Adjust Steps 12 and 13 in the Horizontal section of the "Adjustment Procedure".

2. Adjust Trigger Sensitivity (R479)

a. Set:

VERTICAL MODE	CH 1
CH 1 VOLTS/DIV	0.1 V
Input Coupling (both)	AC
SEC/DIV	10 μs
INT	VERT MODE

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—Trigger Sensitivity (R479) while rotating the TRIGGER LEVEL control slowly so that the Trigger is just able to be maintained.

3. Adjust Slope Balance (R471)

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

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 TRIGGER SLOPE switch between the OUT and IN positions.

4. Adjust P-P Auto Trigger Centering (R434 and R435)

a. Set:

TRIGGER SLOPE	OUT
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:

TRIGGER SLOPE	IN
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
SEC/DIV	0.2 μs

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 TRIGGER LEVEL control for each switch combination given in Table 5-8.

Table 5-8
Switch Combinations for Triggering Checks

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

e.. Set the VERTICAL MODE to CH 2.

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

g. Repeat part d.

h. Set:

SEC/DIV	0.1 μs
X10 Magnifier	On (knob out)

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

j. Repeat part d.

k. Set the VERTICAL MODE to CH 1.

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

m. Repeat part d.

n. 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	NO DLY
SEC/DIV	0.1 μs
X10 Magnifier	Off (knob in)
SOURCE	EXT

b. Connect the leveled sine-wave generator output via a 50 Ω cable, a 50 Ω 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 TRIGGER LEVEL control for each switch combination given in Table 5-8.

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
SEC/DIV	20 μs
X10 Magnifier	Off (knob in)
TRIGGER Mode	NORM

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

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

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

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

f. Set the TRIGGER SLOPE button to IN.

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

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

8. Check Single Sweep Operation

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

b. Set:

Channel 1 Input Coupling	GND
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 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)
- Two 50 Ω BNC Cables (Item 4)
- 50 Ω BNC Termination (Item 5)
- BNC T-Connector (Item 8)
- 10X Probe (provided with instrument)

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	NO DLY
SEC/DIV	20 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
INT	VERT MODE
SOURCE	INT

PROCEDURE STEPS

1. Check External Z-Axis Operation

a. Connect the leveled sine-wave generator output via a 50 Ω cable and a T-connector to the CH 1 OR X input connector. Then connect a 50 Ω cable and a 50 Ω 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
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 2213A Oscilloscope.

STATIC-SENSITIVE COMPONENTS

The following precautions are applicable when performing any maintenance involving internal access to the instrument.

CAUTION

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[a]
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

[a]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 in 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).

CAUTION

To prevent damage from electrical arcing, ensure that circuit boards and components are dry before applying power to the instrument.

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.

CAUTION

Most spray-type circuit coolants contain Freon 12 as a propellant. Because many Freons adversely affect switch contacts, do not use spray-type coolants.

The only recommended circuit coolants for the volts-division attenuators are dry ice (CO) and isopropyl alcohol.

a. Use only isopropyl alcohol as a cleaning solution, especially in the area of the vertical Attenuator circuit board.

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.

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 revealed 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 without 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 7 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 diagram 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 of 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. 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.

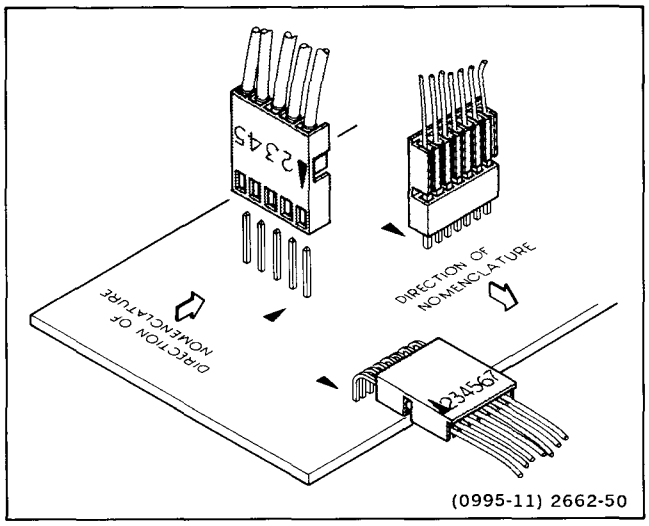


Figure 6-1. Multi-connector holder orientation.

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, semiconductors 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 either of 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 INTENSITY control to minimum brightness and the 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 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" section in the "Adjustment" procedure 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 kΩ 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 kΩ 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	Specification	Usage	Example
1. Soldering Iron	15 to 25 W.	General soldering and unsoldering.	Antex Precision Model C.
2. Torx Screwdriver Tips and Handle	Torx tips: #T7, #T9, #T10, #T15, and #T20. Handle: 1/4 inch hex drive.	Assembly and disassembly.	Tektronix Part Numbers: #T7 003-1293-00 #T9 003-0965-00 #T10 003-0814-00 #T15 003-0966-00 #T20 003-0866-00. Handles: 8 1/2 in. 003-0293-00 3 1/2 in. 003-0445-00.
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.	Tektronix Part Number: 9/16 003-0502-00.
5. Hex Wrenches	0.050 inch, 1/16 inch.	Assembly and disassembly.	Allen Wrenches.
6. Long-nose Pliers		Component removal and replacement.	Diamalloy Model LN55-3.
7. Diagonal Cutters		Component removal and replacement.	Diamalloy Model M554-3.
8. Vacuum Solder Extractor	No static charge retention.	Unsoldering static sensitive devices and components on multilayer boards.	Pace Model PC-10.
9. Contact Cleaner	No-Noise R.	Switch and pot cleaning.	Tektronix Part Number 006-0442-02.
10. Pin-Replacement Kit		Replace circuit board connector pins.	Tektronix Part Number 040-0542-01.
11. IC-Removal Tool		Removing DIP IC packages.	Augat T114-1.
12. Isopropyl Alcohol	Reagent grade.	Cleaning attenuator and front panel assemblies.	2-Isopropanol.
13. Isolation Transformer		Isolate the instrument from the ac power source for safety.	Tektronix Part Number 006-5953-00.
14. 1X Probe		Power supply ripple check.	TEKTRONIX P6101A.
15. Bayonet Ground Assembly		Signal interconnect for power supply ripple check.	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.

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. Remove the screw from the bottom front of the cabinet and 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 four screws removed in step 2.

CAUTION

To ensure that the cabinet is grounded to the instrument chassis, the screws at the right rear side and bottom front 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.

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 and that the crt socket-wire assembly is in its cutout.

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).

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.

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 screws in the SEC/DIV Variable and SEC/DIV switch knobs and remove them. Note the position of the SEC/DIV knob for reinstallation reference.

2. 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 9-wire connector located on the right edge of the Timing circuit board.

3. Remove one screw at the rear of the Attenuator circuit board (securing both the Attenuator and the Timing circuit boards to the Bottom shield).

4. Remove the remaining three screws securing the Timing circuit board to the Bottom shield.

5. Pull the Timing circuit board straight back from the front of the instrument until the switch shaft is clear of the Front-Panel circuit board.

To reinstall the Timing circuit board, perform the following steps:

6. 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.

7. Reinstall three screws securing the Timing circuit board to the bottom shield (removed in step 4).

8. 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 3).

9. Reconnect two connectors to the Timing circuit board (disconnected in step 2).

10. Reinstall the SEC/DIV dial in the position noted in step 1 and secure it with the set screw.

11. 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 and 2 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 7 and 8 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 9 through 11 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. Pull the FOCUS, Channel 1 and Channel 2 POSITION, TRIGGER LEVEL, and VAR HOLDOFF knobs off of their control shafts. Loosen the set screw in the INTENSITY knob with a 1/16-inch Hex-key and pull the knob off.

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.

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 40 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 40 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 (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 MULTIPLIER potentiometer connector (P4644) from the Main circuit board (located in front of the Power-Supply shield).

2. Remove the Power-Supply shield and plastic power-supply cover (see "Power-Supply Shield" removal procedure).

3. Unsolder five wires from the Filter circuit board (leading to the Main circuit board).

4. Remove connectors from the Attenuator and Timing circuit boards, noting their locations for reinstallation reference.

5. Remove the FOCUS control shaft assembly by pulling it straight out from the front panel.

6. 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.

7. Disconnect P9001 and P9002 from the rear of the Main circuit board near the fuse holder.

8. Unsolder the rear-panel EXT Z AXIS connector wire from the Main circuit board.

9. 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.

10. 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.

11. Unsolder two sets of crt socket wires from the Main circuit board, noting wire color and position for reinstallation reference.

12. Unsolder two sets of delay-line wires from the Main circuit board, noting wire color and position for reinstallation reference.

13. Remove three screws securing the Bottom shield to the Main circuit board.

25. Insert and resolder the EXT Z AXIS connector wire into the Main circuit board (removed in step 8).

26. Reconnect P9001 and P9002 to the Main circuit board (removed in step 7).

27. 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.

28. Reinstall the FOCUS control shaft assembly (removed in step 5).

29. Reconnect the connectors to the Attenuator and Timing circuit boards (removed in step 4).

30. Resolder five wires from the Filter circuit board to the Main circuit board (unsoldered in step 3).

31. Reinstall the Power-Supply shield and plastic power-supply cover (see "Power-Supply Shield" reinstallation procedure).

32. Reconnect the MULTIPLIER 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 μF
10 kHz	0.33 μF

OPTIONS

There are currently no options for the 2213A, 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.

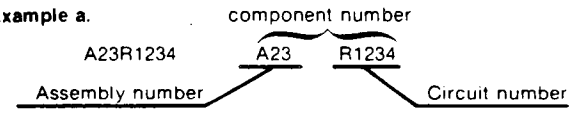
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

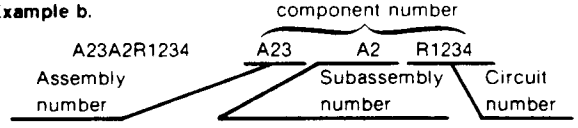
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

Example a.



Read: Resistor 1234 of Assembly 23

Example b.



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 Code
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
00853	SANGAMO WESTON INC COMPONENTS DIV	SANGAMO RD PO BOX 128	PICKENS SC 29671-9716
01121	ALLEN-BRADLEY CO	1201 S 2ND ST	MILWAUKEE WI 53204-2410
01281	MOTOROLA INC RF & OPTOELECTRONIC PRODUCTS DIV	14520 AVIATION BLVD	LAWNDALE CA 90260-1121
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
02113	COILCRAFT INC	1102 SILVER LAKE RD	CARY IL 60013-1658
02114	AMPEREX ELECTRONIC CORP FERROXCUBE DIV	5083 KINGS HWY	SAUGERTIES NY 12477
02735	RCA CORP SOLID STATE DIVISION	ROUTE 202	SOMERVILLE NJ 08876
03508	GENERAL ELECTRIC CO SEMI-CONDUCTOR PRODUCTS DEPT	W GENESEE ST	AUBURN NY 13021
04099	CAPCO INC	1328 WINTERS AVE PO BOX 1028	GRAND JUNCTION CO 81502
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05397	UNION CARBIDE CORP MATERIALS SYSTEMS DIV	11901 MADISON AVE	CLEVELAND OH 44101
07263	FAIRCHILD SEMICONDUCTOR CORP NORTH AMERICAN SALES SUB OF SCHLUMBERGER LTD MS 118	10400 RIDGEVIEW CT	CUPERTINO CA 95014
07716	TRW INC TRW IRC FIXED RESISTORS/BURLINGTON	2850 MT PLEASANT AVE	BURLINGTON IA 52601
12954	MICROSEMI CORP - SCOTTSDALE	8700 E THOMAS RD P O BOX 1390	SCOTTSDALE AZ 85252
12969	UNITRODE CORP	5 FORBES RD	LEXINGTON MA 02173-7305
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
14193	CAL-R INC	1601 OLYMPIC BLVD PO BOX 1397	SANTA MONICA CA 90406
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
14752	ELECTRO CUBE INC	1710 S DEL MAR AVE	SAN GABRIEL CA 91776-3825
15238	ITT SEMICONDUCTORS A DIVISION OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORP	500 BROADWAY PO BOX 168	LAWRENCE MA 01841-3002
15454	AMETEK INC RODAN DIV	721 N POPLAR ST	ORANGE CA 92668
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
18324	SIGNETICS CORP MILITARY PRODUCTS DIV	4130 S MARKET COURT	SACRAMENTO CA 95834-1222
18796	MURATA ERIE NORTH AMERICAN INC STATE COLLEGE OPERATIONS	1900 W COLLEGE AVE	STATE COLLEGE PA 16801-2723
19396	ILLINOIS TOOL WORKS INC PAKTRON DIV	1205 MCCONVILLE RD PO BOX 4539	LYNCHBURG VA 24502-4535
19701	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO MINERAL WELLS AIRPORT	PO BOX 760	MINERAL WELLS TX 76067-0760
20932	KYOCERA INTERNATIONAL INC	11620 SORRENTO VALLEY RD PO BOX 81543 PLANT NO 1	SAN DIEGO CA 92121
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
24546	CORNING GLASS WORKS	550 HIGH ST	BRADFORD PA 16701-3737
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
25403	AMPEREX ELECTRONIC CORP SEMICONDUCTOR SOLID STATE AND ACTIVE DEVICES-ELECTRO OPTICAL DEVICES	GEORGE WASHINGTON HWY	SMITHFIELD RI 02917
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
34899	FAIR-RITE PRODUCTS CORP	1 COMMERCIAL ROW	WALLKILL NY 12589
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
51642	CENTRE ENGINEERING INC	2820 E COLLEGE AVE	STATE COLLEGE PA 16801-7515
52763	STETCO INC	3344 SCHIERHORN	FRANKLIN PARK IL 60131
52769	SPRAGUE-GOODMAN ELECTRONICS INC	134 FULTON AVE	GARDEN CITY PARK NY 11040-5352
54473	MATSUSHITA ELECTRIC CORP OF AMERICA	ONE PANASONIC WAY PO BOX 1501	SECAUCUS NJ 07094-2917
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
54937	DEYOUNG MANUFACTURING INC	12920 NE 125TH WAY	KIRKLAND WA 98034-7716
55112	WESTLAKE CAPACITORS INC	5334 STERLING CENTER DRIVE	WESTLAKE VILLAGE CA 91361
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195-4526
56289	SPRAGUE ELECTRIC CO WORLD HEADQUARTERS	92 HAYDEN AVE	LEXINGTON MA 02173-7929
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58361	QUALITY TECHNOLOGIES CORP	3400 HILLVIEW AVE	PALO ALTO CA 94304-1319
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON AZ 85740-7144
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
71590	MEPCO/CENTRALAB INC A NORTH AMERICAN PHILIPS CO	HWY 20 W PO BOX 858	FORT DODGE IA 50501
75042	IRC ELECTRONIC COMPONENTS PHILADELPHIA DIV TRW FIXED RESISTORS	401 N BROAD ST	PHILADELPHIA PA 19108-1001
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
80031	MEPCO/ELECTRA INC	22 COLUMBIA RD	MORRISTOWN NJ 07960
81483	INTERNATIONAL RECTIFIER	9220 SUNSET BLVD	LOS ANGELES CA 90069-3501
82389	SWITCHCRAFT INC SUB OF RAYTHEON CO	5555 N ELSTRON AVE	CHICAGO IL 60630-1314
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601-3632
95348	GORDOS CORP	250 GLENWOOD AVE	BLOOMFIELD NJ 07003-2416
D5243	ROEDERSTEIN E SPEZIALFABRIK FUER KONDENSATOREN GMBN	LUDMILLASTRASSE 23-25	8300 LANDSHUT GERMANY
TK0213	TOPTRON CORP		TOKYO JAPAN
TK0515	ERICSSON COMPONENTS INC	403 INTERNATIONAL PKY PO BOX 853904	RICHARDSON TX 75085-3904
TK1339	PREM MAGNETICS INC	3521 N CHAPEL HILL RD	MCHENRY IL 60050
TK1395	ROEDERSTEIN ELECTRONICS INC	2100 W FRONT ST	STATESVILLE NC 28677-3651
TK1421	COILTRON	PO BOX 904	BEAVERTON OR 97075
TK1450	TOKYO COSMOS ELECTRIC CO LTD	2-268 SOBUDAI ZAWA	KANAGAWA 228 JAPAN
TK1483	TEKA PRODUCTS INC	45 SALEM ST	PROVIDENCE RI 02907
TK1573	WILHELM WESTERMAN	PO BOX 2345 AUGUSTA-ANLAGE 56	6800 MANNHEIM 1 WEST GERMANY
TK2048	UNION CARBIDE INC KEMET DIV	401 PARK PL SUITE 219	KIRKLAND WA 98033
TK2165	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-7520-00	B010100	B016089	CIRCUIT BD ASSY:MAIN	80009	670-7520-00
A1	670-7520-01	B016090	B019979	CIRCUIT BD ASSY:MAIN	80009	670-7520-01
A1	670-7520-02	B019980	B025749	CIRCUIT BD ASSY:MAIN	80009	670-7520-02
A1	670-7520-03	B025750	B026929	CIRCUIT BD ASSY:MAIN A1	80009	670-7520-03
A1	670-7520-04	B026930	B027294	CIRCUIT BD ASSY:MAIN A1	80009	670-7520-04
A1	670-7520-05	B027295	B029299	CIRCUIT BD ASSY:MAIN,A1	80009	670-7520-05
A1	670-7520-06	B029300		CIRCUIT BD ASSY:MAIN	80009	670-7520-06
A2	672-0086-00	B010100	B012830	CIRCUIT BD ASSY:ATTENUATOR	80009	672-0086-00
A2	670-8267-01	B012831	B020966	CIRCUIT BD ASSY:ATTEN	80009	670-8267-01
A2	670-8267-02	B020967	B027736	CIRCUIT BD ASSY:ATTENUATOR	80009	670-8267-02
A2	670-7561-03	B027737	B028489	CIRCUIT BD ASSY:ATTENUATOR	80009	670-7561-03
A2	670-7561-04	B028490		CIRCUIT BD ASSY:ATTENUATOR	80009	670-7561-04
A3	670-8264-00	B010100	B012313	CIRCUIT BD ASSY:FRONT PANEL	80009	670-8264-00
A3	670-8264-01	B012314		CIRCUIT BD ASSY:FRONT PANEL	80009	670-8264-01
A4	670-8285-00			CIRCUIT BD ASSY:TIMING	80009	670-8285-00
A6	670-7615-00	B010100	B029496	CIRCUIT BD ASSY:EMI FILTER	80009	670-7615-00
A6	670-7615-01	B029497		CIRCUIT BD ASSY:EMI FILTER	80009	670-7615-01

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	670-7520-00	B010100	B016089	CIRCUIT BD ASSY:MAIN	80009	670-7520-00
A1	670-7520-01	B016090	B019979	CIRCUIT BD ASSY:MAIN	80009	670-7520-01
A1	670-7520-02	B019980	B025749	CIRCUIT BD ASSY:MAIN	80009	670-7520-02
A1	670-7520-03	B025750	B026929	CIRCUIT BD ASSY:MAIN A1	80009	670-7520-03
A1	670-7520-04	B026930	B027294	CIRCUIT BD ASSY:MAIN A1	80009	670-7520-04
A1	670-7520-05	B027295	B029299	CIRCUIT BD ASSY:MAIN,A1	80009	670-7520-05
A1	670-7520-06	B029300		CIRCUIT BD ASSY:MAIN	80009	670-7520-06
A1C100	283-0853-00	B025800		CAP,FXD,CER DI:2.2PF,200V	TK2048	C322C22902G5CA
A1C114	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C115	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C116	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C125	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C126	283-0114-00	B010100	B021209	CAP,FXD,CER DI:1500PF,5%,200V	59660	805-534-Y5D0152J
A1C126	285-1346-00	B021210		CAP,FXD,PLASTIC:1500PF,100V,5%	55112	185(1500PF)
A1C130	283-0642-00			CAP,FXD,MICA DI:33PF,+/-0.5PF,500V	00853	D105E330G0
A1C133	281-0785-00			CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
A1C150	283-0853-00	B025800		CAP,FXD,CER DI:2.2PF,200V	TK2048	C322C22902G5CA
A1C164	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C165	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C175	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C176	283-0114-00	B010100	B021209	CAP,FXD,CER DI:1500PF,5%,200V	59660	805-534-Y5D0152J
A1C176	285-1346-00	B021210		CAP,FXD,PLASTIC:1500PF,100V,5%	55112	185(1500PF)
A1C180	283-0642-00			CAP,FXD,MICA DI:33PF,+/-0.5PF,500V	00853	D105E330G0
A1C200	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
A1C201	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
A1C210	281-0511-00			CAP,FXD,CER DI:22PF,+/-2.2PF,500V	52763	2RDPLZ007 22POKC
A1C215	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C220	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C225	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C226	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C228	281-0630-00			CAP,FXD,CER DI:390PF,5%,500V	52763	2RDPLZ007 390PMO
A1C229	281-0630-00			CAP,FXD,CER DI:390PF,5%,500V	52763	2RDPLZ007 390PMO
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%,100V	20932	401E0100AD121J
A1C240	283-0331-00			CAP,FXD,CER DI:43PF,2%,100V	18796	DD106B10NP0430J
A1C241	281-0816-00			CAP,FXD,CER DI:82 PF,5%,100V	04222	MA106A820JAA
A1C242	281-0812-00			CAP,FXD,CER DI:1000PF,10%,100V	04222	MA101C102KAA
A1C250	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A1C251	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A1C255	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C262	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C274	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C312	281-0895-00			CAP,FXD,CER DI:6.8PF,100WVDC	04222	MA101A6R8DAA
A1C337	281-0895-00			CAP,FXD,CER DI:6.8PF,100WVDC	04222	MA101A6R8DAA
A1C363	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C369	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C377	281-0576-00			CAP,FXD,CER DI:11PF,5%,500V	52763	2RDPLZ007 MPOJC
A1C379	281-0780-00			CAP,FXD,CER DI:3.3PF,+0.25PF,500V,N.P.O.	80009	281-0780-00
A1C380	281-0578-00			CAP,FXD,CER DI:18PF,5%,500V	52763	2RDPLZ007 18POJC
A1C381	283-0663-00			CAP,FXD,MICA DI:16.8PF,+/0.5PF,500V	00853	D155C16R8D0
A1C389	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C390	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C392	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C396	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
A1C397	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C405	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C408	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C414	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1C415	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
A1C418	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C419	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A1C420	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C421	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C451	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C453	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C459	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C473	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C479	281-0895-00			CAP,FXD,CER DI:6.8PF,100WVDC	04222	MA101A6R8DAA
A1C480	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C494	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C499	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
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	12954	D3R3EA15K1
A1C502	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
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	12954	D3R3EA15K1
A1C505	290-0183-00			CAP,FXD,ELCTLT:1UF,10%,35V	05397	T3228105K035AS
A1C506	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
A1C507	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C511	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C517	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C518	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	MA201C472KAA
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	12954	D3R3EA15K1
A1C525	281-0895-00			CAP,FXD,CER DI:6.8PF,100WVDC	04222	MA101A6R8DAA
A1C527	281-0797-00			CAP,FXD,CER DI:15PF,10%,100V	04222	SA106A150KAA
A1C529	281-0777-00			CAP,FXD,CER DI:51PF,5%,100V	04222	MA101A510JAA
A1C531	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C536	281-0776-00			CAP,FXD,CER DI:120PF,5%,100V	20932	401E0100AD121J
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	MA101C10ZMAA
A1C539	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C540	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C545	283-0119-00	B010100	B021209	CAP,FXD,CER DI:2200PF,5%,200V	59660	855-XXXY5E0222J
A1C545	285-1345-00	B021210		CAP,FXD,PLASTIC:2200PF,100V,5%	55112	185(2200PF)
A1C547	281-0767-00	B010100	B017098	CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C547	281-0864-00	B017099		CAP,FXD,CER DI:430PF,5%,100V	54583	MA12C0G2A431J
A1C553	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C554	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C561	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C590	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
A1C606	285-1280-00			CAP,FXD,MTLZD:0.022UF,5%,250VDC	55112	171/.022/J/250/C
A1C607	283-0397-00			CAP,FXD,CER DI:1160PF,2%,100V	04222	SR301AVG6GAA
A1C610	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C615	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C616	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C617	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C629	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C630	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C631	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C764	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C775	281-0214-00			CAP,VAR,CER DI:0.6-3PF,400V	52763	313613-140
A1C777	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA106E222MAA
A1C779	285-1101-00			CAP,FXD,PLASTIC:0.022UF,10%,200V	19396	223K02PT485
A1C780	281-0812-00			CAP,FXD,CER DI:1000PF,10%,100V	04222	MA101C102KAA
A1C782	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1C785	283-0317-00			CAP,FXD,CER DI:1PF,+/-0.1PF,500V	59660	861518C0K0109B
A1C787	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA106E222MAA
A1C789	285-1101-00			CAP,FXD,PLASTIC: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	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C799	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
A1C824	281-0785-00			CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
A1C825	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
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:2200PF,20%,200V	04222	SA106E222MAA
A1C847	283-0057-00	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C847	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
A1C849	283-0057-00	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C849	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
A1C851	283-0057-00	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C851	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
A1C853	281-0791-00			CAP,FXD,CER DI:270PF,10%,100V	04222	MA101C271KAA
A1C854	283-0279-00			CAP,FXD,CER DI:0.001UF,20%,3000V	51406	DHR12Y5S102M3KV
A1C855	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	56289	430P582
A1C871	283-0057-00	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C871	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
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	B010100	B015234	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C893	283-0279-00			CAP,FXD,CER DI:0.001UF,20%,3000V	51406	DHR12Y5S102M3KV
A1C904	285-1192-00			CAP,FXD,PPR DI:0.0022 UF,20%,250VAC	TK0515	PME271Y510
A1C906	290-0978-00			CAP,FXD,ELCTLT:75UF,+50-10%,450V	56289	17D1149
A1C907	285-0932-00	B010100	B025084	CAP,FXD,PLASTIC:1UF,10%,400V	04099	C705D105K
A1C907	285-1177-01	B025085		CAP,FXD,PLASTIC:1UF,10%,450V	80009	285-1177-01
A1C908	283-0481-00			CAP,FXD,CER DI:220PF,10%,250VAC	TK1395	RK0611
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	MA101C182KAA
A1C922	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A1C925	290-0973-01			CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	UVX1E101MPA1TA
A1C940	290-0922-00			CAP,FXD,ELCTLT:1000UF,20%,50V	55680	ULB1E102TFAANA
A1C941	283-0057-00	B010100	B025714	CAP,FXD,CER DI:0.1UF,+80-20%,200V	04222	SR306E104ZAA
A1C941	285-1341-00	B025715		CAP,FXD,PLASTIC:0.1UF,20%,100V	TK1573	MKS2 0.1/100/20
A1C942	290-0768-00			CAP,FXD,ELCTLT:10UF,+50-20%,100WVDC	54473	ECE-A100V10L
A1C943	290-0768-00			CAP,FXD,ELCTLT:10UF,+50-20%,100WVDC	54473	ECE-A100V10L
A1C944	290-0183-00			CAP,FXD,ELCTLT:1UF,10%,35V	05397	T3228105K035AS
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 W/SLEEVE	55680	UHC2C330TFA
A1C956	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	00853	301EN271W040B2
A1C960	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C961	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C962	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C963	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C968	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C970	290-0945-00			CAP,FXD,ELCTLT:840UF 10 + 100 %,12V	00853	301EN841U012B2
A1C975	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	56289	430P582
A1C976	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	56289	430P582
A1C979	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	56289	430P582
A1CR133	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR183	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)

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A1CR226	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR227	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR228	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR229	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR372	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR381	152-0141-02	B010100	B016640	SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR381	152-0245-00	B016641	B025374	SEMICOND DVC,DI:SW,SI,40V,DO-7	03508	DA2740
A1CR381	152-0141-02	B025375	B028095	SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR381	152-0245-00	B028096		SEMICOND DVC,DI:SW,SI,40V,DO-7	03508	DA2740
A1CR393	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR399	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR414	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR415	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR503	152-0075-00			SEMICOND DVC,DI:SW,GE,22V,80MW,DO-7	80009	152-0075-00
A1CR508	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR509	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR514	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR518	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR529	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR551	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR556	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR580	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR583	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR617	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR630	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR764	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR765	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR768	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR770	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR780	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR818	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR820	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR821	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR823	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR824	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR825	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR829	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR840	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR845	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR851	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A1CR853	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A1CR854	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A1CR855	152-0242-00			SEMICOND DVC,DI:SIG,SI,225V,0.2A,DO-7	07263	FDH5004
A1CR879	152-0413-00	B010100	B015234	SEMICOND DVC,DI:RECT,SI,400V,1.0A,A59	04713	SR2046KRL
A1CR901	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR902	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR903	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR904	152-0040-00			SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41	80009	152-0040-00
A1CR907	152-0808-00			SEMICOND DVC,DI:RECT,SI,400V,1.5 A,50 NS	01281	DSR3400X
A1CR908	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR920	152-0061-00			SEMICOND DVC,DI:SW,SI,175V,0.1A,DO-35	07263	FDH2161
A1CR946	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR947	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR948	152-0141-02	B029300		SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR948	119-3511-00	B029300		COMBO ASSY:DIODE & RES,HT SK (INCLUDES CR948 & R948)	80009	119-3511-00
A1CR954	152-0414-00	B010100	B019979	SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR954	152-0413-00	B019980		SEMICOND DVC,DI:RECT,SI,400V,1.0A,A59	04713	SR2046KRL

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1CR955	152-0413-00			SEMICOND DVC,DI:RECT,SI,400V,1.0A,A59	04713	SR2046KRL
A1CR956	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR957	152-0413-00	B010100	B019979	SEMICOND DVC,DI:RECT,SI,400V,1.0A,A59	04713	SR2046KRL
A1CR957	152-0414-00	B019980		SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR960	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR961	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR962	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR963	152-0414-00			SEMICOND DVC,DI:RECT,SI,200V,1.0A,TEK A59	80009	152-0414-00
A1CR967	152-0581-00			SEMICOND DVC,DI:RECT,SI,20V,1A,A59	04713	1N5817
A1CR970	152-0581-00			SEMICOND DVC,DI:RECT,SI,20V,1A,A59	04713	1N5817
A1DS856	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	TK0213	JH005/3011JA
A1DS858	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	TK0213	JH005/3011JA
A1DS870	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	TK0213	JH005/3011JA
A1DS9150	150-1071-01			LT EMITTING DIO:GREEN,565NM,20MA MAX W/WIRE	80009	150-1071-01
A1E200	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E201	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E272	119-1771-00			FERRITE BEAD AS:276-0532-00 W/22 AWG WIRE	80009	119-1771-00
A1E590	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E907	276-0635-00			CORE,EM:TOROID,FERRITE	02114	768 T188/3E2A
A1L960	108-1058-00			COIL,RF:FIXED,10UH	02113	B8724
A1L961	108-1058-00			COIL,RF:FIXED,10UH	02113	B8724
A1P9644	131-0608-00	B010100	B021208	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 3)	22526	48283-036
A1P9644	131-0589-00	B021209		TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 3)	22526	48283-029
A1P9802	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 2)	22526	48283-029
A1Q102	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q103	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q114	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q115	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q152	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q153	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q164	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q165	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q202	151-0471-00	B010100	B024699	TRANSISTOR:NPN,SI,TO-92	04713	SPS8619
A1Q202	151-0212-00	B024700		TRANSISTOR:NPN,SI,TO-72	04713	SRF 518
A1Q203	151-0471-00	B010100	B024699	TRANSISTOR:NPN,SI,TO-92	04713	SPS8619
A1Q203	151-0212-00	B024700		TRANSISTOR:NPN,SI,TO-72	04713	SRF 518
A1Q206	151-0221-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0221-00
A1Q207	151-0221-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0221-00
A1Q230	151-0221-02			TRANSISTOR:PNP,SI,TO-106	07263	S42530
A1Q231	151-0221-02			TRANSISTOR:PNP,SI,TO-106	07263	S42530
A1Q254	151-0752-00	B010100	B018381	TRANSISTOR:NPN,SI,MARCO T	25403	BFR96
A1Q254	151-0752-01	B018382		TRANSISTOR:NPN,SI,MARCO T	04713	SRF3188
A1Q255	151-0752-00	B010100	B018381	TRANSISTOR:NPN,SI,MARCO T	25403	BFR96
A1Q255	151-0752-01	B018382		TRANSISTOR:NPN,SI,MARCO T	04713	SRF3188
A1Q256	151-0752-00			TRANSISTOR:NPN,SI,MARCO T	25403	BFR96
A1Q257	151-0752-00			TRANSISTOR:NPN,SI,MARCO T	25403	BFR96
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			SEMICOND DVC SE:FET,SI,TO-92	80009	151-1042-00
A1Q384	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q397	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q402	151-0276-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8025
A1Q403	151-0276-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8025

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A1Q413	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q419	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q420	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q421	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q422	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q423	151-0424-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8246
A1Q428	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q429	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q460	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q463	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A1Q509	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q511	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q525	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q576	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q578	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q606	151-0424-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8246
A1Q611	151-0192-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8801
A1Q739	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1Q756	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1Q770	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q775	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A1Q779	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A1Q780	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q785	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A1Q789	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A1Q804	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q825	151-0424-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8246
A1Q829	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q835	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q840	151-0347-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS7951
A1Q845	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS6700
A1Q885	151-0443-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS7950
A1Q908	151-0164-00			TRANSISTOR:PNP,SI,TO-92	04713	MPS2907A
A1Q928	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1Q930	151-0164-00			TRANSISTOR:PNP,SI,TO-92	04713	MPS2907A
A1Q935	151-0506-00	B010100	B026929	SCR:SI,RD-44	80009	151-0506-00
A1Q935	151-0565-00	B026930		THYRISTOR,SCR:8A,200V,SENS GATE,TO-220	80009	151-0565-00
A1Q938	151-0276-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8025
A1Q939	151-0276-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8025
A1Q944	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A1R100	315-0430-00	B010100	B025749	RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R100	315-0620-00	B025750	B027294	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A1R100	315-0430-00	B027295		RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R101	315-0430-00	B010100	B025749	RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R101	315-0620-00	B025750	B027294	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A1R101	315-0430-00	B027295		RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R103	321-0155-00			RES,FXD,FILM:402 OHM,1%,0.125W,TC=T0	07716	CEAD402R0F
A1R104	321-0101-00			RES,FXD,FILM:110 OHM,1%,0.125W,TC=T0	07716	CEAD110R0F
A1R105	321-0101-00			RES,FXD,FILM:110 OHM,1%,0.125W,TC=T0	07716	CEAD110R0F
A1R106	321-0161-00			RES,FXD,FILM:464 OHM,1%,0.125W,TC=T0	07716	CEAD464R0F
A1R108	321-0223-00			RES,FXD,FILM:2.05K OHM,1%,0.125W,TC=T0	19701	5033ED2K05F
A1R109	321-0221-00			RES,FXD,FILM:1.96K OHM,1%,0.125W,TC=T0	19701	5043ED1K960F
A1R114	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W,TC=T0	19701	5033ED2K15F
A1R115	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W,TC=T0	19701	5033ED2K15F
A1R120	321-0123-00			RES,FXD,FILM:187 OHM,1%,0.125W, TC=T0	07716	CEAD187R0F
A1R121	321-0123-00			RES,FXD,FILM:187 OHM,1%,0.125W, TC=T0	07716	CEAD187R0F
A1R122	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R125	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4

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A1R126	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A1R130	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R131	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R132	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R133	315-0111-00			RES,FXD,FILM:110 OHM,5%,0.25W	57668	NTR25J-E110E
A1R135	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R136	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R139	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R142	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R143	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R144	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R145	311-1238-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3386X-DY6-502
A1R150	315-0430-00	B010100	B025749	RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R150	315-0620-00	B025750	B027294	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A1R150	315-0430-00	B027295		RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R151	315-0430-00	B010100	B025749	RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R151	315-0620-00	B025750	B027294	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A1R151	315-0430-00	B027295		RES,FXD,FILM:43 OHM,5%,0.25W	19701	5043CX43R00J
A1R153	321-0155-00			RES,FXD,FILM:402 OHM,1%,0.125W,TC=T0	07716	CEAD402R0F
A1R154	321-0101-00			RES,FXD,FILM:110 OHM,1%,0.125W,TC=T0	07716	CEAD110R0F
A1R155	321-0101-00			RES,FXD,FILM:110 OHM,1%,0.125W,TC=T0	07716	CEAD110R0F
A1R156	321-0161-00			RES,FXD,FILM:464 OHM,1%,0.125W,TC=T0	07716	CEAD464R0F
A1R158	321-0223-00			RES,FXD,FILM:2.05K OHM,1%,0.125W,TC=T0	19701	5033ED2K05F
A1R159	321-0221-00			RES,FXD,FILM:1.96K OHM,1%,0.125W,TC=T0	19701	5043ED1K960F
A1R164	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W,TC=T0	19701	5033ED2K15F
A1R165	321-0225-00			RES,FXD,FILM:2.15K OHM,1%,0.125W,TC=T0	19701	5033ED2K15F
A1R170	321-0123-00			RES,FXD,FILM:187 OHM,1%,0.125W, TC=T0	07716	CEAD187R0F
A1R171	321-0123-00			RES,FXD,FILM:187 OHM,1%,0.125W, TC=T0	07716	CEAD187R0F
A1R172	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R175	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R176	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A1R180	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R181	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A1R182	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R183	315-0111-00			RES,FXD,FILM:110 OHM,5%,0.25W	57668	NTR25J-E110E
A1R185	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R186	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R189	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R192	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R193	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R194	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R195	311-1238-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3386X-DY6-502
A1R202	321-0178-00			RES,FXD,FILM:698 OHM,1%,0.125W,TC=T0	07716	CEAD698R0F
A1R203	321-0178-00			RES,FXD,FILM:698 OHM,1%,0.125W,TC=T0	07716	CEAD698R0F
A1R204	321-0089-00			RES,FXD,FILM:82.5 OHM,1%,0.125W,TC=T0	91637	CMF55116G82R50F
A1R206	321-0139-00			RES,FXD,FILM:274 OHM,1%,0.125W,TC=T0	07716	CEAD274R0F
A1R207	321-0139-00			RES,FXD,FILM:274 OHM,1%,0.125W,TC=T0	07716	CEAD274R0F
A1R210	315-0221-00	B010100	B021299	RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R210	315-0331-00	B021300		RES,FXD,FILM:330 OHM,5%,0.25W	57668	NTR25J-E330E
A1R210	315-0221-00	B021300		RES,FXD,FILM:220 OHM,5%,0.25W (TEST SELECTABLE VALUE)	57668	NTR25J-E220E
A1R212	321-0086-00			RES,FXD,FILM:76.8 OHM,1%,0.125W,TC=T0	91637	CMF55116G76R80F
A1R213	321-0086-00			RES,FXD,FILM:76.8 OHM,1%,0.125W,TC=T0	91637	CMF55116G76R80F
A1R215	321-0135-00			RES,FXD,FILM:249 OHM,1%,0.125W,TC=T0	07716	CEAD249R0F
A1R216	321-0163-00			RES,FXD,FILM:487 OHM,1%,0.125W,TC=T0	07716	CEAD487R0F
A1R217	321-0163-00			RES,FXD,FILM:487 OHM,1%,0.125W,TC=T0	07716	CEAD487R0F
A1R218	321-0102-00			RES,FXD,FILM:113 OHM,1%,0.125W,TC=T0	07716	CEAD113R0F
A1R219	321-0102-00			RES,FXD,FILM:113 OHM,1%,0.125W,TC=T0	07716	CEAD113R0F

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A1R220	307-0104-00			RES,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5
A1R222	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R223	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R225	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R226	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R227	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R230	321-0086-00			RES,FXD,FILM:76.8 OHM,1%,0.125W,TC=T0	91637	CMF55116G76R80F
A1R231	321-0086-00			RES,FXD,FILM:76.8 OHM,1%,0.125W,TC=T0	91637	CMF55116G76R80F
A1R233	321-0085-00			RES,FXD,FILM:75 OHM,1%,0.125W,TC=T0	57668	CRB14FXE 75 OHM
A1R234	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A1R235	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A1R236	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A1R239	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R240	311-1248-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386X-T07-501
A1R241	311-1237-00			RES,VAR,NONWW:1K OHM,10%,0.50W	32997	3386X-DY6-102
A1R242	315-0273-00			RES,FXD,FILM:27K OHM,5%,0.25W	57668	NTR25J-E27K0
A1R244	321-0172-00			RES,FXD,FILM:604 OHM,1%,0.125W,TC=T0	19701	5033ED604R0F
A1R245	321-0172-00			RES,FXD,FILM:604 OHM,1%,0.125W,TC=T0	19701	5033ED604R0F
A1R250	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R251	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R254	321-0119-00			RES,FXD,FILM:169 OHM,1%,0.125W,TC=T0	07716	CEAD169R0F
A1R255	321-0119-00			RES,FXD,FILM:169 OHM,1%,0.125W,TC=T0	07716	CEAD169R0F
A1R256	322-0175-00			RES,FXD,FILM:649 OHM,1%,0.25W,TC=T0	75042	CEBT0-6490F
A1R257	322-0175-00			RES,FXD,FILM:649 OHM,1%,0.25W,TC=T0	75042	CEBT0-6490F
A1R258	322-0180-00			RES,FXD,FILM:732 OHM,1%,0.25W,TC=T0	75042	CEBT0-7320F
A1R259	322-0180-00			RES,FXD,FILM:732 OHM,1%,0.25W,TC=T0	75042	CEBT0-7320F
A1R261	323-0058-00			RES,FXD,FILM:39.2 OHM,1%,0.5W,TC=T0	57668	CRB11FX39R2E
A1R262	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A1R266	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R267	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R268	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R269	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R270	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R271	323-0114-00			RES,FXD,FILM:150 OHM,1%,0.5W,TC=T0	75042	CECT0-1500F
A1R279	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A1R281	315-0821-00			RES,FXD,FILM:820 OHM,5%,0.25W	19701	5043CX820R0J
A1R282	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R283	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R284	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A1R285	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R286	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	91637	CMF55116G49R90F
A1R287	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	91637	CMF55116G49R90F
A1R288	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
A1R289	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
A1R292	321-0179-00			RES,FXD,FILM:715 OHM,1%,0.125W,TC=T0	07716	CEAD715R0F
A1R293	315-0620-00			RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
A1R301	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R302	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R303	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R304	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R305	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R306	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R307	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R309	311-2230-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A1R310	321-0194-00			RES,FXD,FILM:1.02K OHM,1%,0.125W,TC=T0	07716	CEAD10200F
A1R311	321-0194-00			RES,FXD,FILM:1.02K OHM,1%,0.125W,TC=T0	07716	CEAD10200F
A1R312	321-0098-00			RES,FXD,FILM:102 OHM,1%,0.125W,TC=T0	07716	CEAD102R0F
A1R314	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEAD576R0F

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A1R315	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEAD576R0F
A1R317	321-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.125W,TC=T0	19701	5033ED1K82F
A1R318	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A1R319	321-0212-00			RES,FXD,FILM:1.58K OHM,1%,0.125W,TC=T0	19701	5033ED1K58F
A1R321	321-0208-00			RES,FXD,FILM:1.43K OHM,1%,0.125W,TC=T0	19701	5033ED1K43F
A1R322	321-0238-00			RES,FXD,FILM:2.94K OHM,1%,0.125W,TC=T0	07716	CEAD29400F
A1R324	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R326	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R327	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R328	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R329	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R330	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R331	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R332	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R335	321-0203-00			RES,FXD,FILM:1.27K OHM,1%,0.125W,TC=T0	07716	CEAD12700F
A1R336	321-0203-00			RES,FXD,FILM:1.27K OHM,1%,0.125W,TC=T0	07716	CEAD12700F
A1R337	321-0098-00			RES,FXD,FILM:102 OHM,1%,0.125W,TC=T0	07716	CEAD102R0F
A1R339	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEAD576R0F
A1R340	321-0170-00			RES,FXD,FILM:576 OHM,1%,0.125W,TC=T0	07716	CEAD576R0F
A1R342	321-0218-00			RES,FXD,FILM:1.82K OHM,1%,0.125W,TC=T0	19701	5033ED1K82F
A1R343	321-0193-00			RES,FXD,FILM:1K OHM,1%,0.125W,TC=T0	19701	5033ED1K00F
A1R344	321-0212-00			RES,FXD,FILM:1.58K OHM,1%,0.125W,TC=T0	19701	5033ED1K58F
A1R346	321-0208-00			RES,FXD,FILM:1.43K OHM,1%,0.125W,TC=T0	19701	5033ED1K43F
A1R347	321-0238-00			RES,FXD,FILM:2.94K OHM,1%,0.125W,TC=T0	07716	CEAD29400F
A1R349	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R350	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R351	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R352	321-0274-00			RES,FXD,FILM:6.98K OHM,1%,0.125W,TC=T0	19701	5043ED6K980F
A1R353	321-0274-00			RES,FXD,FILM:6.98K OHM,1%,0.125W,TC=T0	19701	5043ED6K980F
A1R354	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A1R356	315-0622-00			RES,FXD,FILM:6.2K OHM,5%,0.25W	19701	5043CX6K200J
A1R357	321-0149-00			RES,FXD,FILM:348 OHM,1%,0.125W,TC=T0	07716	CEAD348R0F
A1R358	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R359	321-0148-00			RES,FXD,FILM:340 OHM,1%,0.125W,TC=T0	07716	CEAD340R0F
A1R360	321-0156-00			RES,FXD,FILM:412 OHM,1%,0.125W,TC=T0	07716	CEAD412R0F
A1R361	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R363	315-0331-00			RES,FXD,FILM:330 OHM,5%,0.25W	57668	NTR25J-E330E
A1R366	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R367	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A1R369	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R372	315-0220-00			RES,FXD,FILM:22 OHM,5%,0.25W	19701	5043CX22R00J
A1R374	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R381	321-0444-00			RES,FXD,FILM:412K OHM,1%,0.125W,TC=T0	07716	CEAD41202F
A1R382	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R384	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A1R385	315-0130-00			RES,FXD,FILM:13 OHM,5%,0.25W	01121	CB1305
A1R386	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A1R389	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R390	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R392	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R393	315-0240-00			RES,FXD,FILM:24 OHM,5%,0.25W	57668	NTR25J-E24E0
A1R395	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A1R397	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20R00J
A1R398	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A1R399	315-0751-00			RES,FXD,FILM:750 OHM,5%,0.25W	57668	NTR25J-E750E
A1R402	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A1R405	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A1R407	315-0752-00			RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5

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A1R408	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R411	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A1R412	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R413	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A1R414	315-0244-00			RES,FXD,FILM:240K OHM,5%,0.25W	19701	5043CX240K0J
A1R415	315-0244-00			RES,FXD,FILM:240K OHM,5%,0.25W	19701	5043CX240K0J
A1R416	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R417	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R419	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A1R420	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R421	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R422	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R423	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R424	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R426	315-0434-00			RES,FXD,FILM:430K OHM,5%,0.25W	57668	NTR25J-E430K
A1R427	315-0434-00			RES,FXD,FILM:430K OHM,5%,0.25W	57668	NTR25J-E430K
A1R428	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R429	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R432	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
A1R433	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	57668	NTR25J-E82K
A1R434	311-1646-00			RES,VAR,NONWW:TRMR,2M OHM,0.5W	32997	3386X-T07-205
A1R435	311-1646-00			RES,VAR,NONWW:TRMR,2M OHM,0.5W	32997	3386X-T07-205
A1R446	315-0224-00			RES,FXD,FILM:220K OHM,5%,0.25W	57668	NTR25J-E220K
A1R451	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R452	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A1R453	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R455	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R457	321-0207-00			RES,FXD,FILM:1.40K OHM,1%,0.125W,TC=T0	19701	5033ED1K400F
A1R458	321-0197-00			RES,FXD,FILM:1.10K OHM,1%,0.125W,TC=T0	07716	CEAD11000F
A1R459	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A1R460	321-0091-00			RES,FXD,FILM:86.6 OHM,1%,0.125W,TC=T0	91637	CMF55116G86R60F
A1R461	321-0203-00			RES,FXD,FILM:1.27K OHM,1%,0.125W,TC=T0	07716	CEAD12700F
A1R462	321-0201-00			RES,FXD,FILM:1.21K OHM,1%,0.125W,TC=T0	19701	5043ED1K210F
A1R463	321-0090-00			RES,FXD,FILM:84.5 OHM,1%,0.125W,TC=T0	91637	CMF55116G84R50F
A1R464	315-0271-00			RES,FXD,FILM:270 OHM,5%,0.25W	57668	NTR25J-E270E
A1R465	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
A1R469	315-0820-00			RES,FXD,FILM:82 OHM,5%,0.25W	57668	NTR25J-E82E0
A1R470	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A1R471	311-1245-00			RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3386X-DY6-103
A1R473	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R474	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A1R478	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R479	311-1236-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3386X-T07-251
A1R483	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R486	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
A1R487	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
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,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R501	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R502	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A1R503	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R504	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A1R505	315-0473-00			RES,FXD,FILM:47K OHM,5%,0.25W	57668	NTR25J-E47K0
A1R507	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R509	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R510	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R511	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R512	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A1R513	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R514	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R516	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R517	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A1R518	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R523	315-0153-00			RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A1R524	321-0318-00			RES,FXD,FILM:20.0K OHM,1%,0.125W,TC=T0	19701	5033ED20K00F
A1R525	321-0322-00			RES,FXD,FILM:22.1K OHM,0.1%,0.125W,TC=T0	19701	5033ED22K10F
A1R526	315-0152-00			RES,FXD,FILM:1.5K OHM,5%,0.25W	57668	NTR25J-E01K5
A1R527	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R528	315-0911-00			RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A1R529	315-0392-00			RES,FXD,FILM:3.9K OHM,5%,0.25W	57668	NTR25J-E03K9
A1R536	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A1R538	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R539	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R540	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R541	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R544	315-0431-00			RES,FXD,FILM:430 OHM,5%,0.25W	19701	5043CX430R0J
A1R545	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R547	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R548	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R549	315-0681-00			RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
A1R555	315-0391-00			RES,FXD,FILM:390 OHM,5%,0.25W	57668	NTR25J-E390E
A1R556	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R558	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R560	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R561	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R562	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R564	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R565	315-0301-00			RES,FXD,FILM:300 OHM,5%,0.25W	57668	NTR25J-E300E
A1R566	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R568	315-0332-00			RES,FXD,FILM:3.3K OHM,5%,0.25W	57668	NTR25J-E03K3
A1R569	315-0432-00			RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A1R571	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R572	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R573	315-0222-00			RES,FXD,FILM:2.2K OHM,5%,0.25W	57668	NTR25J-E02K2
A1R574	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R576	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R577	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R578	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R580	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1R582	315-0181-00			RES,FXD,FILM:180 OHM,5%,0.25W	57668	NTR25J-E180E
A1R586	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R605	315-0132-00			RES,FXD,FILM:1.3K OHM,5%,0.25W	57668	NTR25J-E01K3
A1R606	321-0507-00			RES,FXD,FILM:1.87M OHM,1%,0.125W,TC=T0	91637	CMF110216G18703F
A1R607	321-0375-00			RES,FXD,FILM:78.7K OHM,1%,0.125W,TC=T0	07716	CEAD78701F
A1R610	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A1R611	315-0163-00			RES,FXD,FILM:16K OHM,5%,0.25W	57668	NTR25J-E 16K
A1R613	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R614	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R616	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A1R617	311-2237-00			RES,VAR,NONWW:TRMR,25K OHM,20%,0.5W LINEAR	TK1450	GF06U
A1R620	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R621	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A1R622	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R623	315-0202-00			RES,FXD,FILM:2K OHM,5%,0.25W	57668	NTR25J-E 2K
A1R630	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1

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A1R631	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R632	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R633	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A1R645	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A1R646	311-1563-00			RES,VAR,NONWW:TRMR,1K OHM,0.5W	32997	3352T-DY7-102
A1R647	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R648	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R649	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R673	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R676	315-0471-00			RES,FXD,FILM:470 OHM,5%,0.25W	57668	NTR25J-E470E
A1R715	321-0309-00			RES,FXD,FILM:16.2K OHM,1%,0.125W,TC=T0	19701	5033ED16K20F
A1R730	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A1R731	311-2230-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A1R739	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R746	321-0216-00			RES,FXD,FILM:1.74K OHM,1%,0.125W,TC=T0	07716	CEAD17400F
A1R756	315-0912-00			RES,FXD,FILM:9.1K OHM,5%,0.25W	57668	NTR25J-E09K1
A1R757	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R758	321-0343-00			RES,FXD,FILM:36.5K OHM,1%,0.125W,TC=T0	07716	CEAD36501F
A1R759	321-0267-00			RES,FXD,FILM:5.90K OHM,1%,0.125W,TC=T0	19701	5033ED5K900F
A1R760	311-1565-00			RES,VAR,NONWW:TRMR,250 OHM,0.5W	32997	3352T-1-251
A1R761	321-0210-00			RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A1R764	315-0221-00			RES,FXD,FILM:220 OHM,5%,0.25W	57668	NTR25J-E220E
A1R766	321-0109-00			RES,FXD,FILM:133 OHM,1%,0.125W,TC=T0	07716	CEAD133R0F
A1R768	321-0158-00			RES,FXD,FILM:432 OHM,1%,0.125W,TC=T0	07716	CEAD432R0F
A1R770	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R771	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A1R773	321-0182-00			RES,FXD,FILM:768 OHM,1%,0.125W,TC=T0	07716	CEAD768R0F
A1R775	323-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.5W,TC=T0	75042	CECT0-1652F
A1R776	321-0205-00			RES,FXD,FILM:1.33K OHM,1%,0.125W,TC=T0	19701	5033ED1K330F
A1R777	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R778	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R779	315-0243-00			RES,FXD,FILM:24K OHM,5%,0.25W	57668	NTR25J-E24K0
A1R780	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R781	321-0356-00			RES,FXD,FILM:49.9K OHM,1%,0.125W,TC=T0	19701	5033ED49K90F
A1R782	321-0209-00			RES,FXD,FILM:1.47K OHM,1%,0.125W,TC=T0	19701	5033ED1K47F
A1R783	321-0201-00			RES,FXD,FILM:1.21K OHM,1%,0.125W,TC=T0	19701	5043ED1K210F
A1R785	323-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.5W,TC=T0	75042	CECT0-1652F
A1R786	321-0205-00			RES,FXD,FILM:1.33K OHM,1%,0.125W,TC=T0	19701	5033ED1K330F
A1R787	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R788	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R789	315-0243-00			RES,FXD,FILM:24K OHM,5%,0.25W	57668	NTR25J-E24K0
A1R792	321-0263-00			RES,FXD,FILM:5.36K OHM,1%,0.125W,TC=T0	07716	CEAD53600F
A1R793	321-0361-00			RES,FXD,FILM:56.2K OHM,1%,0.125W,TC=T0	07716	CEAD56201F
A1R796	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R797	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R799	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R800	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A1R804	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R805	315-0562-00			RES,FXD,FILM:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
A1R810	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A1R814	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R818	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R821	315-0362-00			RES,FXD,FILM:3.6K OHM,5%,0.25W	19701	5043CX3K600J
A1R822	301-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.5W	19701	5053CX5K100J
A1R823	301-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.5W	19701	5053CX5K100J
A1R825	315-0750-00			RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A1R826	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R828	315-0560-00			RES,FXD,FILM:56 OHM,5%,0.25W	57668	NTR25J-E56E0

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A1R830	321-0212-00			RES,FXD,FILM:1.58K OHM,1%,0.125W,TC=T0	19701	5033ED1K58F
A1R832	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A1R834	315-0101-00			RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A1R835	321-0228-00			RES,FXD,FILM:2.32K OHM,1%,0.125W,TC=T0	19701	5043ED2K32F
A1R836	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R840	315-0561-00			RES,FXD,FILM:560 OHM,5%,0.25W	19701	5043CX560R0J
A1R841	322-0322-00			RES,FXD,FILM:22.1K OHM,1%,0.25W,TC=T0	19701	5034RD22K1
A1R842	315-0241-00			RES,FXD,FILM:240 OHM,5%,0.25W	19701	5043CX240R0J
A1R844	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R845	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R849	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R851	311-1558-00			RES,VAR,NONWW:TRMR,20K OHM,0.5W	32997	3352T-1-203
A1R852	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R853	315-0244-00			RES,FXD,FILM:240K OHM,5%,0.25W	19701	5043CX240K0J
A1R854	315-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A1R855	315-0102-00	B020825		RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R858	315-0511-00			RES,FXD,FILM:510 OHM,5%,0.25W	19701	5043CX510R0J
A1R860	315-0625-00			RES,FXD,FILM:6.2M OHM,5%,0.25W	01121	CB6255
A1R870	311-1555-00			RES,VAR,NONWW:TRMR,100K OHM,0.5W	32997	3352T-1-104
A1R871	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R872	315-0223-00			RES,FXD,FILM:22K OHM,5%,0.25W	19701	5043CX22K00J92U
A1R873	315-0513-00			RES,FXD,FILM:51K OHM,5%,0.25W	57668	NTR25J-E51K0
A1R874	311-2239-00			RES,VAR,NONWW:TRMR,100K OHM,20%,0.5W LINEAR	TK1450	GF06UT 100K
A1R875	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R877	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R879	315-0514-00	B010100	B015234	RES,FXD,FILM:510K OHM,5%,0.25W	19701	5043CX510K0J
A1R885	315-0912-00			RES,FXD,FILM:9.1K OHM,5%,0.25W	57668	NTR25J-E09K1
A1R886	315-0184-00			RES,FXD,FILM:180K OHM,5%,0.25W	19701	5043CX180K0J
A1R888	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R889	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R890	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R891	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R892	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R893	311-1933-00			RES,VAR,NONWW:PNL,5M OHM,10%,0.5W	01121	23M909
A1R894	301-0514-00			RES,FXD,FILM:510K OHM,5%,0.5W	19701	5053CX510K0J
A1R905	301-0823-00			RES,FXD,FILM:82K OHM,5%,0.5W	19701	5053CX82K00J
A1R906	301-0823-00			RES,FXD,FILM:82K OHM,5%,0.5W	19701	5053CX82K00J
A1R907	308-0843-00			RES,FXD,WW:0.2 OHM,5%,1/0W	91637	RS1A-90-R2J
A1R908	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R909	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A1R910	315-0301-00			RES,FXD,FILM:300 OHM,5%,0.25W	57668	NTR25J-E300E
A1R912	321-0150-00			RES,FXD,FILM:357 OHM,1%,0.125W,TC=T0	07716	CEAD357R0F
A1R913	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A1R914	321-0378-00			RES,FXD,FILM:84.5K OHM,1%,0.125W,TC=T0	07716	CEAD84501F
A1R915	321-0289-00			RES,FXD,FILM:10.0K OHM,1%,0.125W,TC=T0	19701	5033ED10K0F
A1R916	315-0514-00			RES,FXD,FILM:510K OHM,5%,0.25W	19701	5043CX510K0J
A1R917	315-0303-00			RES,FXD,FILM:30K OHM,5%,0.25W	19701	5043CX30K00J
A1R919	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A1R921	315-0303-00			RES,FXD,FILM:30K OHM,5%,0.25W	19701	5043CX30K00J
A1R922	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R925	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A1R926	303-0154-00			RES,FXD,CMPSN:150K OHM,5%,1W	24546	FP1 150K OHM 5%
A1R927	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R928	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A1R929	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A1R930	315-0104-00			RES,FXD,FILM:100K OHM,5%,0.25W	57668	NTR25J-E100K
A1R934	308-0441-00	B010100	B026929	RES,FXD,WW:3 OHM,5%,3W	14193	SA31-3R00J
A1R935	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R937	321-0234-00			RES,FXD,FILM:2.67K OHM,1%,0.125W,TC=T0	19701	5033ED2K67F
A1R938	311-1248-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386X-T07-501
A1R939	321-0304-00			RES,FXD,FILM:14.3K OHM,1%,0.125W,TC=T0	19701	5033ED14K30F
A1R940	315-0203-00			RES,FXD,FILM:20K OHM,5%,0.25W	57668	NTR25J-E 20K
A1R941	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R942	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R943	301-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.5W	19701	5053CX4K700J
A1R944	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R945	301-0202-00			RES,FXD,FILM:2K OHM,5%,0.5W	19701	5053CX2K000J
A1R946	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R947	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R948	315-0100-00	B029300		RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A1R948	119-3511-00	B029300		COMBO ASSY:DIODE & RES,HT SK (INCLUDES CR948 & R948)	80009	119-3511-00
A1R949	308-0677-00			RES,FXD,WW:1 OHM,5%,2W	75042	ORDER BY DESC
A1R964	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
A1R966	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
A1R971	308-0847-01			RES,FXD,WW:0.62 OHM,5%,1W	75042	BW20-R6200J
A1R976	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R978	315-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A1R9272	301-0201-00			RES,FXD,FILM:200 OHM,5%,0.5W	19701	5053CX200R0J
A1R9273	301-0201-00			RES,FXD,FILM:200 OHM,5%,0.5W	19701	5053CX200R0J
A1RT236	307-0125-00			RES,THERMAL:500 OHM,10%,NTC	15454	1DB501K-220-EC
A1S901	260-1849-03			SWITCH,PUSH:DPDT,4A,250VAC,W/COVER	80009	260-1849-03
A1T390	120-1401-00			XFMR,TRIGGER:LINE,1:1 TURNS RATIO	54937	DMI 500-2044
A1T906	120-1439-00	B010100	B024395	TRANSFORMER,RF:ENERGY STORAGE	54937	5002573
A1T906	120-1439-01	B024396		TRANSFORMER,RF:ENERGY STORAGE	TK1339	120-1439-01
A1T944	120-1347-00			TRANSFORMER,RF:DRIVER SATURATING	54583	BDT-001
A1T948	120-1348-01	B010100	B011808	XFMR,PWR,SDN&SU:HIGH VOLTAGE	80009	120-1348-01
A1T948	120-1348-02	B011809	B015060	XFMR,PWR,SDN&SU:HIGH VOLTAGE	80009	120-1348-02
A1T948	120-1348-03	B015061		XFMR,PWR,SDN&SU:HIGH VOLTAGE	80009	120-1348-03
A1TP940	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
A1TP950	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ	22526	48283-029
A1U130	155-0274-00			MICROCKT,LINEAR:VERTICAL PREAMP	80009	155-0274-00
A1U180	155-0274-00			MICROCKT,LINEAR:VERTICAL PREAMP	80009	155-0274-00
A1U225	156-0067-00			MICROCKT,LINEAR:BIPOLAR,OPNL AMPL	04713	MC1741CP1
A1U310	156-0534-00			MICROCKT,LINEAR:DUAL DIFF AMPL	02735	CA3102E-98
A1U335	156-0534-00			MICROCKT,LINEAR:DUAL DIFF AMPL	02735	CA3102E-98
A1U350	156-1294-00			MICROCKT,LINEAR:NPN,5 XSTR ARRAY H FREQ	02735	CA3127E
A1U426	156-0158-00			MICROCKT,LINEAR:BIPOLAR,DUAL OPNL AMPL	04713	MC1458P1/MC1458U
A1U460	156-0534-00			MICROCKT,LINEAR:DUAL DIFF AMPL	02735	CA3102E-98
A1U480	156-0205-03	B010100	B026475	MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	04713	MC10102 L OR P
A1U480	156-0205-00	B026476	B027066	MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	80009	156-0205-00
A1U480	156-0205-03	B027067		MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	04713	MC10102 L OR P
A1U502	156-1713-00			MICROCKT,DGTL:ECL,RETRIG MONOSTABLE MV	04713	MC10198(P OR L)
A1U504	156-1335-00			MICROCKT,DGTL:DUAL RETRIG RESET MONO MV	07263	96LS02PCQR
A1U506	156-1639-00			MICROCKT,DGTL:ECL,DUAL D MA-SLAVE FF	04713	MC10H131(P OR L)
A1U532	156-0205-03	B010100	B026475	MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	04713	MC10102 L OR P
A1U532	156-0205-00	B026476	B027066	MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	80009	156-0205-00
A1U532	156-0205-03	B027067		MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	04713	MC10102 L OR P
A1U537	156-0721-02	B010100	B026475	MICROCKT,DGTL:QUAD ST 2-INP NAND GATES	18324	N74LS132(NBORFB)
A1U537	156-0721-00	B026476		MICROCKT,DGTL:QUAD 2-INP ST NAND GATE	80009	156-0721-00
A1U540	156-0388-03	B010100	B026475	MICROCKT,DGTL:DUAL D FLIP-FLOP,SCRN	01295	SN74LS74ANP3
A1U540	156-0388-00	B026476		MICROCKT,DGTL:DUAL D FLIP-FLOP	01295	SN74LS74 N OR J
A1U555	156-0728-02	B010100	B026475	MICROCKT,DGTL:QUAD 2 INP GATE W/OC OUT,SCRN	01295	SN74LS09NP3
A1U555	156-0728-00	B026476		MICROCKT,DGTL:QUAD 2-INP AND GATE W/OC OUT	01295	SN74LS09(N OR J)
A1U565	156-0384-02	B010100	B026475	MICROCKT,DGTL:QUAD 2-INP NAND GATE,SCRN	07263	74LS03PCQR
A1U565	156-0384-00	B026476		MICROCKT,DGTL:QUAD 2-INP NAND GATE	01295	SN74LS03 N OR J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1U615	156-1126-00			MICROCKT,LINEAR:VOLTAGE COMPARATOR	01295	LM311P
A1U630	156-0875-02	B010100	B026475	MICROCKT,DGTL:DUAL 2-W/2 INP AOI GATES,SCRN	04713	SN74LS51NDS
A1U630	156-0875-00	B026476		MICROCKT,DGTL:DUAL 2-WIDE 2-INP AOI GATES	01295	SN74LS51(N OR J)
A1U930	156-1627-00			MICROCKT,LINEAR:BIPOLAR,PWM PWR SPLY CONT	12969	UC494ACN
A1U975	152-0806-00			SEMICOND DVC,DI:HV MULTR,4KVAC INPUT,12KVDC	12969	CMX647
A1VR615	152-0195-00			SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4W,DO-7	04713	SZ11755RL
A1VR645	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A1VR712	152-0508-00			SEMICOND DVC,DI:ZEN,SI,12.6V,5%,0.4W,DO-7	04713	SZ13294RL
A1VR764	152-0508-00			SEMICOND DVC,DI:ZEN,SI,12.6V,5%,0.4W,DO-7	04713	SZ13294RL
A1VR782	152-0243-00			SEMICOND DVC,DI:ZEN,SI,15V,5%,0.4W,DO-7	04713	SZ13203 (1N965B)
A1VR828	152-0514-00			SEMICOND DVC,DI:ZEN,SI,10V,1%,0.4W,DO-7	04713	SZG15RL
A1VR925	152-0166-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,400MW,DO-7	04713	SZ11738RL
A1VR935	152-0255-00			SEMICOND DVC,DI:ZEN,SI,51V,5%,0.4W,DO-7	04713	SZG35009K7
A1VR943	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A1W142	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W143	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W192	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W193	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W310	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W335	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W350	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W351	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W408	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W410	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W419	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W428	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W429	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W494	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W517	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W519	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W537	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W538	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W553	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W554	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W555	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W556	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W558	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W560	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W582	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W590	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W591	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W592	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W606	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W607	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W615	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W616	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W631	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W726	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W770	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W780	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W885	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W934	131-0566-00	B026930		BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W954	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W955	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W956	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W959	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W960	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1W961	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W964	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W965	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W968	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W971	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W972	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W974	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W975	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W976	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W977	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W979	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W991	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W993	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W995	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W997	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W998	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W999	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W9000	131-3148-00	B010100	B012313	CONN,RCPT,ELEC:HEADER,1 X 36,0.1 SPACING	TK1483	082364OSS40RAM
A1W9000	131-3229-00	B012314		CONN,RCPT,ELEC:HEADER,1 X 19,0.1 SPACING	TK1483	082-2540-SS29
A1W9000	131-3229-01	B012314		CONN,RCPT,ELEC:HEADER,1 X 21,0.1 SPACING	TK1483	082-3440-SS29
A1W9070	198-4819-00			WIRE SET,ELEC:POWER FET	80009	198-4819-00
A1W9103	175-6138-00	B010100	B025749	CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	175-6138-00
A1W9103	175-6138-01	B025750	B027294	CA ASSY,SP,ELEC:4,6.25 L,FLEX STRIP	80009	175-6138-01
A1W9103	175-6138-00	B027295		CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	175-6138-00
A1W9108	175-6138-00	B010100	B025749	CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	175-6138-00
A1W9108	175-6138-01	B025750	B027294	CA ASSY,SP,ELEC:4,6.25 L,FLEX STRIP	80009	175-6138-01
A1W9108	175-6138-00	B027295		CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	175-6138-00
A1W9272	195-7063-00			LEAD,ELECTRICAL:22 AWG,2.0 L,9-N	80009	195-7063-00
A1W9273	195-8235-00			LEAD,ELECTRICAL:22 AWG,2.5 L,9-N	80009	195-8235-00
A1W9700	175-6642-00			CA ASSY,SP,ELEC:9,26 AWG,8.0 L,RIBBON	80009	175-6642-00
A1W9705	175-6137-00	B010100	B025749	CA ASSY,SP,ELEC:8,26 AWG,6.0 L,RIBBON	80009	175-6137-00
A1W9705	175-6137-01	B025750		CA ASSY,SP,ELEC:8,6.25 L,FLEX STRIP	80009	175-6137-01
A1W9778	195-7065-00	B010100	B024499	LEAD,ELECTRICAL:22 AWG,1.5 L,9-2	80009	195-7065-00
A1W9778	195-7064-00	B024500		LEAD,ELECTRICAL:22 AWG,2.25 L,9-N	80009	195-7064-00
A1W9788	195-7064-00			LEAD,ELECTRICAL:22 AWG,2.25 L,9-N	80009	195-7064-00
A1W9870	136-0202-08			SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT	80009	136-0202-08
A1W9991	175-6139-00	B010100	B025749	CA ASSY,SP,ELEC:3,26 AWG,4.0 L,RIBBON	80009	175-6139-00
A1W9991	175-6139-01	B025750		CA ASSY,SP,ELEC:3,4.25 L,FLEX STRIP	80009	175-6139-01

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2	672-0086-00	B010100	B012830	CIRCUIT BD ASSY:ATTENUATOR	80009	672-0086-00
A2	670-8267-01	B012831	B020966	CIRCUIT BD ASSY:ATTEN	80009	670-8267-01
A2	670-8267-02	B020967	B027736	CIRCUIT BD ASSY:ATTENUATOR	80009	670-8267-02
A2	670-7561-03	B027737	B028489	CIRCUIT BD ASSY:ATTENUATOR	80009	670-7561-03
A2	670-7561-04	B028490		CIRCUIT BD ASSY:ATTENUATOR	80009	670-7561-04
A2A1	----- -----			CIRCUIT BD ASSY:ATTENUATOR (NOT AVAILABLE, SEE A2)		
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	B010100	B020966	CAP,FXD,PLASTIC:0.019UF,10%,600V,RADIAL LD	80009	285-1132-02
A2C2	285-1106-00	B020967		CAP,FXD,PLASTIC:0.022UF,20%,600V	14752	230B1F223
A2C3	281-0182-00	B010100	B012830	CAP,VAR,PLASTIC:1.8-10PF,300V	19701	2805D1R810BH03F0
A2C3	281-0182-01	B012831	B020966	CAP,VAR,PLASTIC:1.8-10PF,300V	80031	2805D1R810BH02F0
A2C3	281-0158-00	B020967	B026958	CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER	59660	518-006 G 7-45
A2C3	281-0294-00	B026959		CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C6	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A2C7	283-0185-00	B020967	B025644	CAP,FXD,CER DI:2.5PF,0.5%,50V	51642	100-050-NP0-259B
A2C7	283-0898-00	B025645		CAP,FXD,CER DI:2.7PF,50V,0.25%	51406	RPE110C062R7C50V
A2C9	281-0770-00	B010100	B020966	CAP,FXD,CER DI:1000PF,20%,100V	04222	MA101C102MAA
A2C9	281-0826-00	B020967		CAP,FXD,CER DI:2200PF,10%,100V	20932	401EM100AD222K
A2C10	283-0028-00	B010100	B020966	CAP,FXD,CER DI:0.0022UF,20%,50V	59660	0805585Y5S0222M
A2C10	283-0100-00	B020967		CAP,FXD,CER DI:0.0047UF,10%,200V	04222	SR306A472KAA
A2C13	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C17	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C21	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A2C26	281-0294-00	B027737		CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C27	281-0893-00	B027737		CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
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	MA101C10ZMAA
A2C38	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C52	285-1132-02	B010100	B020966	CAP,FXD,PLASTIC:0.019UF,10%,600V,RADIAL LD	80009	285-1132-02
A2C52	285-1106-00	B020967		CAP,FXD,PLASTIC:0.022UF,20%,600V	14752	230B1F223
A2C53	281-0182-00	B010100	B012830	CAP,VAR,PLASTIC:1.8-10PF,300V	19701	2805D1R810BH03F0
A2C53	281-0182-01	B012831	B020966	CAP,VAR,PLASTIC:1.8-10PF,300V	80031	2805D1R810BH02F0
A2C53	281-0158-00	B020967	B026958	CAP,VAR,CER DI:7-45PF,100WVDC SUBMIN CER	59660	518-006 G 7-45
A2C53	281-0294-00	B026959		CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C56	283-0000-00			CAP,FXD,CER DI:0.001UF,+100-0%,500V	59660	831-610-Y5U0102P
A2C57	283-0185-00	B020967	B025644	CAP,FXD,CER DI:2.5PF,0.5%,50V	51642	100-050-NP0-259B
A2C57	283-0898-00	B025645		CAP,FXD,CER DI:2.7PF,50V,0.25%	51406	RPE110C062R7C50V
A2C59	281-0770-00	B010100	B020966	CAP,FXD,CER DI:1000PF,20%,100V	04222	MA101C102MAA
A2C59	281-0826-00	B020967		CAP,FXD,CER DI:2200PF,10%,100V	20932	401EM100AD222K
A2C60	283-0028-00	B010100	B020966	CAP,FXD,CER DI:0.0022UF,20%,50V	59660	0805585Y5S0222M
A2C60	283-0100-00	B020967		CAP,FXD,CER DI:0.0047UF,10%,200V	04222	SR306A472KAA
A2C63	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C67	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C71	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A2C76	281-0294-00	B027737		CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C77	281-0893-00	B027737		CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
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	MA101C10ZMAA
A2C88	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C90	290-0523-00	B010100	B020966	CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T368A225M020AS
A2C90	290-0776-01	B020967		CAP,FXD,ELCTLT:22UF,20%,10WVDC	55680	ULB1A220MAA1TD
A2C91	290-0523-00	B010100	B020966	CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T368A225M020AS
A2C91	290-0776-01	B020967		CAP,FXD,ELCTLT:22UF,20%,10WVDC	55680	ULB1A220MAA1TD
A2C93	290-0776-00	B010100	B020966	CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2C93	290-0776-01	B020967		CAP,FXD,ELCTLT:22UF,20%,10WVDC	55680	ULB1A220MAA1TD
A2C94	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C96	290-0776-00	B010100	B020966	CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A2C96	290-0776-01	B020967		CAP,FXD,ELCTLT:22UF,20%,10WVDC	55680	ULB1A220MAA1TD
A2C97	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2CR7	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
A2CR18	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR57	152-0324-00			SEMICOND DVC,DI:SW,SI,35V,0.1A,DO-7	14552	MT5128
A2CR68	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2E90	276-0532-00	B010100	B020966	SHLD BEAD,ELEK:FERRITE	02114	56-590-65/4A6
A2E91	276-0532-00	B010100	B020966	SHLD BEAD,ELEK:FERRITE	02114	56-590-65/4A6
A2L90	120-0382-00	B020967	B027662	COIL,RF:210UH,+28%-43%,14 TURNS	80009	120-0382-00
A2L90	120-0382-01	B027663		COIL,RF:210UH,+28/-43%,14 TURNS	80009	120-0382-01
A2L91	120-0382-00	B020967	B027662	COIL,RF:210UH,+28%-43%,14 TURNS	80009	120-0382-00
A2L91	120-0382-01	B027663		COIL,RF:210UH,+28/-43%,14 TURNS	80009	120-0382-01
A2L93	120-0382-00	B010100	B027662	COIL,RF:210UH,+28%-43%,14 TURNS	80009	120-0382-00
A2L93	120-0382-01	B027663		COIL,RF:210UH,+28/-43%,14 TURNS	80009	120-0382-01
A2L96	120-0382-00	B010100	B027662	COIL,RF:210UH,+28%-43%,14 TURNS	80009	120-0382-00
A2L96	120-0382-01	B027662		COIL,RF:210UH,+28/-43%,14 TURNS	80009	120-0382-01
A2P9091	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 3)	22526	48283-036
A2P9103	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 4)	22526	48283-036
A2P9108	131-0608-00			TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 4)	22526	48283-036
A2P9200	131-0787-00			TERMINAL,PIN:0.64 L X 0.025 SQ PH BRZ (QUANTITY OF 2)	22526	47359-000
A2Q13	151-1124-00			TRANSISTOR:JFE,N-CHAN,SI,SEL,TO-92	17856	J-2400
A2Q15	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A2Q18	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A2Q63	151-1124-00			TRANSISTOR:JFE,N-CHAN,SI,SEL,TO-92	17856	J-2400
A2Q65	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A2Q68	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A2R2	317-0105-00	B010100	B028489	RES,FXD,CMPSN:1M OHM,5%,0.125W	01121	BB1055
A2R2	322-3481-00	B028490		RES,FXD,FILM:1M OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R3	321-1731-00	B010100	B020966	RES,FXD,FILM:500K OHM,1%,0.125W,TC=T0	19701	5033RD500K0F
A2R3	322-0614-00	B020967		RES,FXD,FILM:250K OHM,1%,0.25W,TC=T0	75042	CEBT0-2503F
A2R4	317-0056-00	B010100	B020966	RES,FXD,CMPSN:5.6 OHM,5%,0.125W	01121	BB56G5
A2R4	317-0082-00	B020967		RES,FXD,CMPSN:8.2 OHM,5%,0.125W	01121	BB82G5
A2R5	321-1731-00	B010100	B020966	RES,FXD,FILM:500K OHM,1%,0.125W,TC=T0	19701	5033RD500K0F
A2R5	321-0469-00	B020967	B028489	RES,FXD,FILM:750K OHM,1%,0.125W,TC=T0	80009	321-0469-00
A2R5	322-3469-00	B028490		RES,FXD,FILM:750K OHM,1%,0.2W,TC=T0	80009	322-3469-00
A2R6	317-0105-00	B010100	B028489	RES,FXD,CMPSN:1M OHM,5%,0.125W	01121	BB1055
A2R6	322-3481-00	B028490		RES,FXD,FILM:1M OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R7	315-0160-00	B010100	B027736	RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R7	315-0180-00	B027737		RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
A2R8	315-0220-01	B010100	B020966	RES,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A2R8	315-0620-02	B020967		RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R9	315-0112-00	B010100	B020966	RES,FXD,FILM:1.1K OHM,5%,0.25W	19701	5043CX1K100J
A2R9	315-0432-00	B020967	B028489	RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A2R9	322-3251-00	B028490		RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A2R10	311-1559-00	B010100	B020966	RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3352T-1-103
A2R10	311-2238-00	B020967		RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R11	315-0153-00	B010100	B020966	RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A2R11	315-0102-00	B020967	B028489	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R11	322-3193-00	B028490		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R12	315-0360-00	B020967		RES,FXD,FILM:36 OHM,5%,0.25W	19701	5043CX36R00J
A2R13	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R13	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R14	317-0161-00	B010100	B028489	RES,FXD,CMPSN:160 OHM,5%,0.125W	01121	BB1615
A2R14	322-3117-00	B028490		RES,FXD,FILM:162 OHM,1%,0.2W,TC=T0	57668	CRB 20 FXE 162E
A2R15	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R15	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R16	315-0162-00	B020967	B028489	RES,FXD,FILM:1.6K OHM,5%,0.25W	19701	5043CX1K600J
A2R16	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R17	315-0201-00	B010100	B028489	RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A2R17	322-3126-00	B028490		RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A2R18	315-0911-00	B010100	B028489	RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A2R18	322-3189-00	B028490		RES,FXD,FILM:909 OHM,1%,0.2W,TC=T0	57668	CRB 20 FXE 909E
A2R19	307-0843-00			RES NTWK,FXD,FI:INPUT ATTENUATOR	80009	307-0843-00
A2R21	315-0160-00			RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R22	321-0210-00	B010100	B028489	RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R22	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R23	321-0210-00	B010100	B028489	RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R23	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R25	311-1568-00	B010100	B020966	RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3352T-1-500
A2R25	311-2226-00	B020967		RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W	TK1450	GF06UT 50 OHM
A2R26	311-0643-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329H-L58-500
A2R27	315-0160-00	B027737		RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R29	321-0090-00	B010100	B028489	RES,FXD,FILM:84.5 OHM,1%,0.125W,TC=T0	91637	CMF55116G84R50F
A2R29	322-3089-00	B028490		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	57668	CRB20 FXE 82E5
A2R30	315-0124-00	B010100	B028489	RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A2R30	322-3392-00	B028490		RES,FXD,FILM:118K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 118K
A2R31	315-0750-00	B010100	B028489	RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A2R31	322-3085-00	B028490		RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A2R33	311-1556-00	B010100	B020966	RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3352T-DY7-503
A2R33	311-2238-00	B020967		RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R34	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R34	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R35	321-0144-00	B010100	B028489	RES,FXD,FILM:309 OHM,1%,0.125W,TC=T0	07716	CEAD309R0F
A2R35	322-3143-00	B028490		RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R37	315-0102-00	B010100	B028489	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R37	322-3193-00	B028490		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R38	321-0144-00	B010100	B028489	RES,FXD,FILM:309 OHM,1%,0.125W,TC=T0	07716	CEAD309R0F
A2R38	322-3143-00	B028490		RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R39	315-0242-00	B010100	B028489	RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A2R39	322-3231-00	B028490		RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K49
A2R41	321-0154-00	B010100	B012830	RES,FXD,FILM:392 OHM,1%,0.125W,TC=T0	07716	CEAD392R0F
A2R41	321-0151-00	B012831	B028489	RES,FXD,FILM:365 OHM,1%,0.125W,TC=T0	07716	CEAD365R0F
A2R41	322-3135-00	B028490		RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 249E
A2R42	315-0333-00	B010100	B028489	RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A2R42	322-3335-00	B028490		RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 30K1
A2R43	311-2179-00			RES,VAR,NONWW:PNL,10K OHM,10%,0.5W	32997	91Z1D-Z07-EA0037
A2R46	315-0472-00	B010100	B020966	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A2R46	315-0182-00	B020967	B028489	RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A2R46	322-3210-00	B028489		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R47	311-1224-00	B010100	B020966	RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386F-T04-501
A2R47	311-2230-00	B020967		RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A2R48	315-0512-00	B010100	B020966	RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A2R48	315-0752-00	B020967	B028489	RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A2R48	322-3269-00	B028490		RES,FXD,FILM:6.19K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 6K19
A2R52	317-0105-00	B010100	B028489	RES,FXD,CMPSN:1M OHM,5%,0.125W	01121	BB1055
A2R52	322-3481-00	B028490		RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R53	321-1731-00	B010100	B020966	RES,FXD,FILM:500K OHM,1%,0.125W,TC=T0	19701	5033RD500K0F
A2R53	322-0614-00	B020967		RES,FXD,FILM:250K OHM,1%,0.25W,TC=T0	75042	CEBT0-2503F
A2R54	317-0056-00	B010100	B020966	RES,FXD,CMPSN:5.6 OHM,5%,0.125W	01121	BB56G5
A2R54	317-0082-00	B020967		RES,FXD,CMPSN:8.2 OHM,5%,0.125W	01121	BB82G5

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R55	321-1731-00	B010100	B020966	RES,FXD,FILM:500K OHM,1%,0.125W,TC=T0	19701	5033RD500K0F
A2R55	321-0469-00	B020967	B028489	RES,FXD,FILM:750K OHM,1%,0.125W,TC=T0	80009	321-0469-00
A2R55	322-3469-00	B028490		RES,FXD,FILM:750K OHM,1%,0.2W,TC=T0	80009	322-3469-00
A2R56	317-0105-00	B010100	B028489	RES,FXD,CMPSN:1M OHM,5%,0.125W	01121	BB1055
A2R56	322-3481-00	B028490		RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R57	315-0160-00	B010100	B027736	RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R57	315-0180-00	B027737		RES,FXD,FILM:18 OHM,5%,0.25W	19701	5043CX18R00J
A2R58	315-0220-01	B010100	B020966	RES,FXD,CMPSN:22 OHM,5%,0.25W	01121	CB2205
A2R58	315-0620-02	B020967		RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R59	315-0112-00	B010100	B020966	RES,FXD,FILM:1.1K OHM,5%,0.25W	19701	5043CX1K100J
A2R59	315-0432-00	B020967	B028489	RES,FXD,FILM:4.3K OHM,5%,0.25W	57668	NTR25J-E04K3
A2R59	322-3251-00	B028490		RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K02
A2R60	311-1559-00	B010100	B020966	RES,VAR,NONWW:TRMR,10K OHM,0.5W	32997	3352T-1-103
A2R60	311-2238-00	B020967		RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R61	315-0153-00	B010100	B020966	RES,FXD,FILM:15K OHM,5%,0.25W	19701	5043CX15K00J
A2R61	315-0102-00	B020967	B028489	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R61	322-3193-00	B028490		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R62	315-0360-00	B020967		RES,FXD,FILM:36 OHM,5%,0.25W	19701	5043CX36R00J
A2R63	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R63	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R64	317-0161-00	B010100	B028489	RES,FXD,CMPSN:160 OHM,5%,0.125W	01121	BB1615
A2R64	322-3117-00	B028490		RES,FXD,FILM:162 OHM,1%,0.2W,TC=T0	57668	CRB 20 FXE 162E
A2R65	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R65	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R66	315-0162-00	B020967	B028489	RES,FXD,FILM:1.6K OHM,5%,0.25W	19701	5043CX1K600J
A2R66	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R67	315-0201-00	B010100	B028489	RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A2R67	322-3126-00	B028490		RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A2R68	315-0911-00	B010100	B028489	RES,FXD,FILM:910 OHM,5%,0.25W	57668	NTR25J-E910E
A2R68	322-3189-00	B028490		RES,FXD,FILM:909 OHM,1%,0.2W,TC=T0	57668	CRB 20 FXE 909E
A2R69	307-0843-00			RES NTWK,FXD,FI:INPUT ATTENUATOR	80009	307-0843-00
A2R71	315-0160-00			RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R72	321-0210-00	B010100	B028489	RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R72	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R73	321-0210-00	B010100	B028489	RES,FXD,FILM:1.50K OHM,1%,0.125W,TC=T0	19701	5033ED1K50F
A2R73	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R75	311-1568-00	B010100	B020966	RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3352T-1-500
A2R75	311-2226-00	B020967		RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W	TK1450	GF06UT 50 OHM
A2R76	311-0643-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329H-L58-500
A2R77	315-0160-00	B027737		RES,FXD,FILM:16 OHM,5%,0.25W	19701	5043CX16R00J
A2R79	321-0090-00	B010100	B028489	RES,FXD,FILM:84.5 OHM,1%,0.125W,TC=T0	91637	CMF55116G84R50F
A2R79	322-3089-00	B028490		RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	57668	CRB20 FXE 82E5
A2R80	315-0124-00	B010100	B028489	RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A2R80	322-3392-00	B028490		RES,FXD,FILM:118K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 118K
A2R81	315-0750-00	B010100	B028489	RES,FXD,FILM:75 OHM,5%,0.25W	57668	NTR25J-E75E0
A2R81	322-3085-00	B028490		RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A2R83	311-1556-00	B010100	B020966	RES,VAR,NONWW:TRMR,50K OHM,0.5W	32997	3352T-DY7-503
A2R83	311-2238-00	B020967		RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R84	315-0101-00	B010100	B028489	RES,FXD,FILM:100 OHM,5%,0.25W	57668	NTR25J-E 100E
A2R84	322-3097-00	B028490		RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R85	321-0144-00	B010100	B028489	RES,FXD,FILM:309 OHM,1%,0.125W,TC=T0	07716	CEAD309R0F
A2R85	322-3143-00	B028490		RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R87	315-0102-00	B010100	B028489	RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A2R87	322-3193-00	B028490		RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R88	321-0144-00	B010100	B028489	RES,FXD,FILM:309 OHM,1%,0.125W,TC=T0	07716	CEAD309R0F
A2R88	322-3143-00	B028490		RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R91	321-0154-00	B010100	B012830	RES,FXD,FILM:392 OHM,1%,0.125W,TC=T0	07716	CEAD392R0F
A2R91	321-0151-00	B012831	B028489	RES,FXD,FILM:365 OHM,1%,0.125W,TC=T0	07716	CEAD365R0F

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A2R91	322-3135-00	B028490		RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 249E
A2R93	311-2179-00			RES,VAR,NONWW:PNL,10K OHM,10%,0.5W	32997	91Z1D-Z07-EA0037
A2R96	315-0472-00	B010100	B020966	RES,FXD,FILM:4.7K OHM,5%,0.25W	57668	NTR25J-E04K7
A2R96	315-0182-00	B020967	B028489	RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A2R96	322-3210-00	B028490		RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R97	311-1224-00	B010100	B020966	RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386F-T04-501
A2R97	311-2230-00	B020967		RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A2R98	315-0512-00	B010100	B020966	RES,FXD,FILM:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
A2R98	315-0752-00	B020967	B028489	RES,FXD,FILM:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
A2R98	322-3269-00	B028490		RES,FXD,FILM:6.19K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 6K19
A2S1	263-1040-00	B010100	B012659	SWITCH ASSEMBLY:CHANNEL 1 DIVISION	80009	263-1040-00
A2S1	263-1040-01	B012660		SWITCH ASSEMBLY:ACTUATOR,COUPLING	TK2165	ORDER BY DESCR
A2S10	263-1041-00			SWITCH ASSEMBLY:ACTUATOR,VOLTS/DIV	TK2165	ORDER BY DESCR
A2S51	263-1040-00	B010100	B012659	SWITCH ASSEMBLY:CHANNEL 1 DIVISION	80009	263-1040-00
A2S51	263-1040-01	B012660		SWITCH ASSEMBLY:ACTUATOR,COUPLING	TK2165	ORDER BY DESCR
A2S60	263-1041-00			SWITCH ASSEMBLY:ACTUATOR,VOLTS/DIV	TK2165	ORDER BY DESCR
A2U10	156-1134-02	B010100	B020966	MICROCKT,LINEAR:OPERATIONAL AMPLIFIER	80009	156-1134-02
A2U10	156-2469-00	B020967		MICROCKT,DGTL:OP AMP	01295	TLC271ACP
A2U30	155-0273-00			MICROCKT,LINEAR:ATTEN AMPLIFIER	80009	155-0273-00
A2U60	156-1134-02	B010100	B020966	MICROCKT,LINEAR:OPERATIONAL AMPLIFIER	80009	156-1134-02
A2U60	156-2469-00	B020967		MICROCKT,DGTL:OP AMP	01295	TLC271ACP
A2U80	155-0273-00			MICROCKT,LINEAR:ATTEN AMPLIFIER	80009	155-0273-00
A2VR10	152-0744-00	B020967		SEMICOND DVC,DI:ZEN,SI,3.6V,5%,0.4W,DO-7	15238	IN747ATK
A2VR60	152-0744-00	B020967		SEMICOND DVC,DI:ZEN,SI,3.6V,5%,0.4W,DO-7	15238	IN747ATK
A2W43	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A2W93	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A2W94	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A2W96	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07

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A3	670-8264-00	B010100	B012313	CIRCUIT BD ASSY:FRONT PANEL	80009	670-8264-00
A3	670-8264-01	B012314		CIRCUIT BD ASSY:FRONT PANEL	80009	670-8264-01
A3C376	283-0006-00	B010100	B021209	CAP,FXD,CER DI:0.02UF,+80-20%,500V	59660	0841545Z5V00203Z
A3C376	285-1363-00	B021210	B029565	CAP,FXD,PLASTIC:0.022UF,20%,400V	55112	160/.022/M/400/C
A3C376	283-0414-00	B029566		CAP,FXD,CER DI:0.022UF,20%,500V	80009	283-0414-00
A3C377	281-0576-00			CAP,FXD,CER DI:11PF,5%,500V	52763	2RDPLZ007 MPOJC
A3C379	283-0780-00			CAP,FXD,MICA DI:125PF,1%,500V	00853	D155F1250F0
A3C380	281-0578-00			CAP,FXD,CER DI:18PF,5%,500V	52763	2RDPLZ007 18POJC
A3C987	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A3CR534	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR537	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR538	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR539	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR601	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR988	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR989	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3DS518	150-1029-00			LT EMITTING DIO:GREEN,565NM,35MA	58361	Q6480/MV5274C
A3J9200	136-0499-02			CONN,RCPT,ELEC:CIRCUIT BD,2 CONTACTS	00779	3-380949-2
A3P9006	131-0589-00			TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 2)	22526	48283-029
A3R89	315-0242-00			RES,FXD,FILM:2.4K OHM,5%,0.25W	57668	NTR25J-E02K4
A3R92	315-0333-00			RES,FXD,FILM:33K OHM,5%,0.25W	57668	NTR25J-E33K0
A3R111	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0	19701	5033ED4K020F
A3R112	311-2178-00			RES,VAR,NONWW:CKT BD,500 OHM,10%,0.5W	01121	W8650B OR APW
A3R161	321-0251-00			RES,FXD,FILM:4.02K OHM,1%,0.125W,TC=T0	19701	5033ED4K020F
A3R162	311-2178-00			RES,VAR,NONWW:CKT BD,500 OHM,10%,0.5W	01121	W8650B OR APW
A3R201	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20R00J
A3R280	311-2147-00			RES,VAR,NONWW:CKT BD,5K OHM,20%,0.50W	01121	W8615C OR APW
A3R377	321-0807-00			RES,FXD,FILM:900K OHM,1%,0.125W,TC=T0	19701	5033RD900K0F
A3R378	321-0617-00			RES,FXD,FILM:111K OHM,1%,0.125W,TC=T0	19701	5043ED250K0F
A3R379	315-0220-00			RES,FXD,FILM:22 OHM,5%,0.25W	19701	5043CX22R00J
A3R380	321-0459-00			RES,FXD,FILM:590K OHM,1%,0.125W,TC=T0	19701	5043ED590K0F
A3R401	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20R00J
A3R438	311-2178-00			RES,VAR,NONWW:CKT BD,500 OHM,10%,0.5W	01121	W8650B OR APW
A3R519	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A3R520	315-0912-00			RES,FXD,FILM:9.1K OHM,5%,0.25W	57668	NTR25J-E09K1
A3R521	311-1235-00			RES,VAR,NONWW:100K OHM,0.5W	32997	3386F-T04-104
A3R602	311-2147-00			RES,VAR,NONWW:CKT BD,5K OHM,20%,0.50W	01121	W8615C OR APW
A3R726	311-2178-00			RES,VAR,NONWW:CKT BD,500 OHM,10%,0.5W	01121	W8650B OR APW
A3R800	315-0682-00			RES,FXD,FILM:6.8K OHM,5%,0.25W	57668	NTR25J-E06K8
A3R802	311-1634-00			RES,VAR,NONWW:PANEL,10K OHM,20%,0.5W	01121	W8743
A3R982	311-2234-00			RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W LINEAR	TK1450	GF06UT 5K
A3R983	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A3R985	315-0114-00			RES,FXD,FILM:110K OHM,5%,0.25W	19701	5043CX110K0J
A3R986	315-0434-00			RES,FXD,FILM:430K OHM,5%,0.25W	57668	NTR25J-E430K
A3R987	315-0124-00			RES,FXD,FILM:120K OHM,5%,0.25W	19701	5043CX120K0J
A3R988	315-0182-00			RES,FXD,FILM:1.8K OHM,5%,0.25W	57668	NTR25J-E1K8
A3R989	321-0239-00			RES,FXD,FILM:3.01K OHM,1%,0.125W,TC=T0	19701	5043ED3K010F
A3R990	321-0126-00			RES,FXD,FILM:200 OHM,1%,0.125W,TC=T0	19701	5033ED200R0F
A3R9376	315-0510-00			RES,FXD,FILM:51 OHM,5%,0.25W	19701	5043CX51R00J
A3S90	260-1995-00			SWITCH,PUSH:1 BUTTON,2 POLE,SLOPE	71590	K40352AB
A3S226	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S380	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S380	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S390	260-2111-00			SWITCH,PUSH:SPDT,MOMENTARY	59821	2LL199NB021085
A3S392	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S392	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S401	260-2110-00			SWITCH,PUSH:1 SPDT/2 DPDT	59821	ORDER BY DESCR

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A3S460	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S545	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S545	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S550	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S550	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S555	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S555	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S601	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S601	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S603	260-2033-00	B010100	B028707	SWITCH,SLIDE:DPTT,125V,0.5A	82389	ORDER BY DESCR
A3S603	260-2033-03	B028708		SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3U985	156-0067-00			MICROCKT,LINEAR:BIPOLAR,OPNL AMPL	04713	MC1741CP1
A3W89	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W515	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W520	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W534	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W539	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W630	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W9520	175-8548-00			CA ASSY,SP,ELEC:2,26 AWG,4.0 L,RIBBON	80009	175-8548-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4	670-8285-00			CIRCUIT BD ASSY:TIMING	80009	670-8285-00
A4C701	295-0138-01			CAP SET,MATCHED:1UF,0.01UF,MATCHED 1% OA	80009	295-0138-01
A4C702	283-0674-00			CAP,FXD,MICA DI:85PF,1%,500V	00853	D155F850F0
A4C703	281-0207-00	B010100	B027926	CAP,VAR,PLASTIC:2-18PF,100V	52769	GXA 18000
A4C703	281-0303-00	B027927		CAP,VAR,CER DI:2.5-20PF,250V	80009	281-0303-00
A4C705	281-0813-00			CAP,FXD,CER DI:0.047UF,20%,50V	05397	C412C473M5V2CA
A4C706	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A4C707	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C708	281-0756-00			CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A4C710	281-0813-00			CAP,FXD,CER DI:0.047UF,20%,50V	05397	C412C473M5V2CA
A4C711	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C712	283-0674-00			CAP,FXD,MICA DI:85PF,1%,500V	00853	D155F850F0
A4C713	281-0207-00			CAP,VAR,PLASTIC:2-18PF,100V	52769	GXA 18000
A4C714	281-0756-00			CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A4C715	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A4C720	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C724	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C725	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C728	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C733	281-0797-00			CAP,FXD,CER DI:15PF,10%,100V	04222	SA106A150KAA
A4C745	281-0776-00			CAP,FXD,CER DI:120PF,5%,100V	20932	401E0100AD121J
A4C747	281-0786-00			CAP,FXD,CER DI:150PF,10%,100V	04222	MA101A151KAA
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	12954	D3R3EA15K1
A4C751	281-0809-00			CAP,FXD,CER DI:200 PF,5%,100V	04222	MA101A201JAA
A4C753	281-0775-00			CAP,FXD,CER DI:0.1UF,20%,50V	04222	MA205E104MAA
A4C755	283-0107-00			CAP,FXD,CER DI:51PF,5%,200V	04222	SR206A510JAA
A4CR732	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR742	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR751	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR752	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4P9250	131-0787-00			TERMINAL,PIN:0.64 L X 0.025 SQ PH BRZ (QUANTITY OF 4)	22526	47359-000
A4P9700	131-0608-00	B010100	B021208	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 10)	22526	48283-036
A4P9700	131-0589-00	B021209		TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 10)	22526	48283-029
A4P9705	131-0608-00	B010100	B021208	TERMINAL,PIN:0.365 L X 0.025 BRZ GLD PL (QUANTITY OF 8)	22526	48283-036
A4P9705	131-0589-00	B021209		TERMINAL,PIN:0.46 L X 0.025 SQ PH BRZ (QUANTITY OF 8)	22526	48283-029
A4Q701	151-0424-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8246
A4Q704	151-1042-00			SEMICOND DVC SE:FET,SI,TO-92	80009	151-1042-00
A4Q706	151-0736-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0736-00
A4Q709	151-0424-00			TRANSISTOR:NPN,SI,TO-92	04713	SPS8246
A4Q710	151-1042-00			SEMICOND DVC SE:FET,SI,TO-92	80009	151-1042-00
A4Q712	151-0736-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0736-00
A4Q728	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	04713	SPS8512
A4Q732	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A4Q737	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q742	151-0712-00			TRANSISTOR:PNP,SI,TO-92	04713	SPS8223
A4Q743	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q757	151-0198-00			TRANSISTOR:SELECTED	80009	151-0198-00
A4Q758	151-0198-00			TRANSISTOR:SELECTED	80009	151-0198-00
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,TC=T0	07716	CCAD24903D
A4R703	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R705	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A4R707	301-0202-00			RES,FXD,FILM:2K OHM,5%,0.5W	19701	5053CX2K000J

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4R709	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R710	315-0151-00			RES,FXD,FILM:150 OHM,5%,0.25W	57668	NTR25J-E150E
A4R711	307-0780-01			RES NTWK,FXD,FI:TIMING	80009	307-0780-01
A4R713	301-0202-00			RES,FXD,FILM:2K OHM,5%,0.5W	19701	5053CX2K000J
A4R715	321-0309-00			RES,FXD,FILM:16.2K OHM,1%,0.125W,TC=T0	19701	5033ED16K20F
A4R716	321-0303-00			RES,FXD,FILM:14.0K OHM,1%,0.125W,TC=T0	07716	CEAD 14001F
A4R717	321-0306-00			RES,FXD,FILM:15.0K OHM,1%,0.125W,TC=T0	19701	5033ED15J00F
A4R718	321-0306-00			RES,FXD,FILM:15.0K OHM,1%,0.125W,TC=T0	19701	5033ED15J00F
A4R719	315-0330-00			RES,FXD,FILM:33 OHM,5%,0.25W	19701	5043CX33R00J
A4R722	315-0201-00			RES,FXD,FILM:200 OHM,5%,0.25W	57668	NTR25J-E200E
A4R724	315-0200-00			RES,FXD,FILM:20 OHM,5%,0.25W	19701	5043CX20R00J
A4R727	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A4R728	321-0222-00			RES,FXD,FILM:2.00K OHM,1%,0.125W,TC=T0	19701	5033ED2K00F
A4R729	315-0302-00			RES,FXD,FILM:3K OHM,5%,0.25W	57668	NTR25J-E03K0
A4R732	321-0247-00			RES,FXD,FILM:3.65K OHM,1%,0.125W,TC=T0	19701	5043ED3K650F
A4R733	321-0231-00			RES,FXD,FILM:2.49K OHM,1%,0.125W,TC=T0	19701	5033ED2K49F
A4R734	315-0272-00			RES,FXD,FILM:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
A4R735	315-0103-00			RES,FXD,FILM:10K OHM,5%,0.25W	19701	5043CX10K00J
A4R736	315-0683-00			RES,FXD,FILM:68K OHM,5%,0.25W	57668	NTR25J-E68K0
A4R737	321-0197-00			RES,FXD,FILM:1.10K OHM,1%,0.125W,TC=T0	07716	CEAD11000F
A4R738	311-1564-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3352T-CK5501
A4R740	311-1562-00			RES,VAR,NONWW:TRMR,2K OHM,0.5W	32997	3352T-DY7-202
A4R741	321-0273-00			RES,FXD,FILM:6.81K OHM,1%,0.125W,TC=T0	07716	CEAD68100F
A4R742	321-0232-00			RES,FXD,FILM:2.55K OHM,1%,0.125W,TC=T0	19701	5043ED2K550F
A4R743	315-0112-00			RES,FXD,FILM:1.1K OHM,5%,0.25W	19701	5043CX1K100J
A4R744	315-0681-00			RES,FXD,FILM:680 OHM,5%,0.25W	57668	NTR25J-E680E
A4R745	315-0623-00			RES,FXD,FILM:62K OHM,5%,0.25W	19701	5043CX62K00J
A4R746	321-0197-00			RES,FXD,FILM:1.10K OHM,1%,0.125W,TC=T0	07716	CEAD11000F
A4R747	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A4R749	311-1560-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3352T-1-502
A4R751	315-0100-00			RES,FXD,FILM:10 OHM,5%,0.25W	19701	5043CX10RR00J
A4R752	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A4R753	311-1560-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3352T-1-502
A4R754	315-0113-00			RES,FXD,FILM:11K OHM,5%,0.25W	19701	5043CX11K00J
A4R755	321-0097-00			RES,FXD,FILM:100 OHM,1%,0.125W,TC=T0	91637	CMF55116G100R0F
A4R756	321-0068-00			RES,FXD,FILM:49.9 OHM,0.5%,0.125W,TC=T0	91637	CMF55116G49R90F
A4R757	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A4R758	315-0621-00			RES,FXD,FILM:620 OHM,5%,0.25W	57668	NTR25J-E620E
A4S701	260-2024-01	B010100	B022899	SWITCH,ROTARY:A SWEEP	80009	260-2024-01
A4S701	260-2024-02	B022900		SWITCH,ROTARY:A SWEEP,POLYSULFONE WAFER	80009	260-2024-02
A4U715	156-0067-00			MICROCKT,LINEAR:BIPOLAR,OPNL AMPL	04713	MC1741CP1
A4U745	156-0048-00			MICROCKT,LINEAR:5 XSTR ARRAY	02735	CA3046
A4U750	156-1150-00			MICROCKT,LINEAR:BIPOLAR,3 TERM NEG V RGLTR	04713	MC79L05ACP
A4U760	155-0124-00			MICROCKT,LINEAR:HORIZ PREAMP	80009	155-0124-00
A4VR720	152-0744-00			SEMICOND DVC,DI:ZEN,SI,3.6V,5%,0.4W,DO-7	15238	IN747ATK
A4VR749	152-0744-00			SEMICOND DVC,DI:ZEN,SI,3.6V,5%,0.4W,DO-7	15238	IN747ATK
A4W707	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A4W711	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A4W752	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A6	670-7615-00	B010100	B029496	CIRCUIT BD ASSY:EMI FILTER	80009	670-7615-00
A6	670-7615-01	B029497		CIRCUIT BD ASSY:EMI FILTER	80009	670-7615-01
A6C900	285-1252-00			CAP,FXD,PLASTIC:0.15UF,10%,250VAC	D5243	F1772-415-2000
A6C902	285-1192-00			CAP,FXD,PPR DI:0.0022 UF,20%,250VAC	TK0515	PME271Y510
A6C903	285-1192-00			CAP,FXD,PPR DI:0.0022 UF,20%,250VAC	TK0515	PME271Y510
A6R900	301-0474-00			RES,FXD,FILM:470K OHM,5%,0.5W	19701	5053CX470K0J
A6R901	301-0512-00			RES,FXD,FILM:5.1K OHM,5%,0.5W	19701	5053CX5K100J
A6R903	301-0331-00			RES,FXD,FILM:330 OHM,5%,0.5W	19701	5053CX330R0J
A6RT901	307-0863-00			RES,THERMAL:10 OHM,10%,NTC	15454	SG-13S
A6T901	120-1449-00			TRANSFORMER,RF:COMMON MODE,2.7MH,2A	02113	P104
A6T903	120-1455-00			TRANSFORMER,RF:DIFFERENTIAL MODE,POT CORE	TK1421	120-1455-00
A6VR901	307-0456-00			RES,V SENSITIVE:250VAC,20W,METAL OXIDE	03508	MOV-V250LA15A
A6W9011	196-0531-00			LEAD,ELECTRICAL:18 AWG,3.0 L,8-01	80009	196-0531-00
A6W9041	195-7745-00			LEAD,ELECTRICAL:18 AWG,3.5 L,8-04	80009	195-7745-00
A6W9091	196-0505-00			LEAD,ELECTRICAL:18 AWG,3.0 L,8-9	80009	196-0505-00
A6W9191	195-7747-00			LEAD,ELECTRICAL:18 AWG,3.5 L,8-19	80009	195-7747-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
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	MDL 1
FL9001	119-1541-01			LINE FILTER AS:1A,250VAC,W/WIRES	80009	119-1541-01
J9100	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	24931	28JR205-2
J9376	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J9510	131-0126-00			CONN,RCPT,ELEC:BNC,FEMALE	24931	28JR205-2
J9800	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
J9900	136-0387-02			JACK,TIP:W/WIRE	80009	136-0387-02
Q9070	151-1151-00	B010100	B026787	TRANSISTOR:MOSFE,N-CHANNEL,SI,TO-220	81483	IRF710
Q9070	151-1152-00	B026788		TRANSISTOR:MOSFE,N-CHANNEL,SI,TO-220	04713	IRF820
R9100	315-0620-00	B010100	B020966	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
R9100	315-0620-02	B020967		RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
R9510	315-0620-00	B010100	B020966	RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
R9510	315-0620-02	B020967		RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
R9521	311-2146-00			RES,VAR,NONWW:CKT BD,50 OHM,20%,0.5W	01121	WA1G040S503MZ
R9615	311-2158-00			RES,VAR,WW:PNL,5K OHM,5%,1W	32997	84A1A-B24-J13
R9644	311-1183-02			RES,VAR,WW:PNL,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:

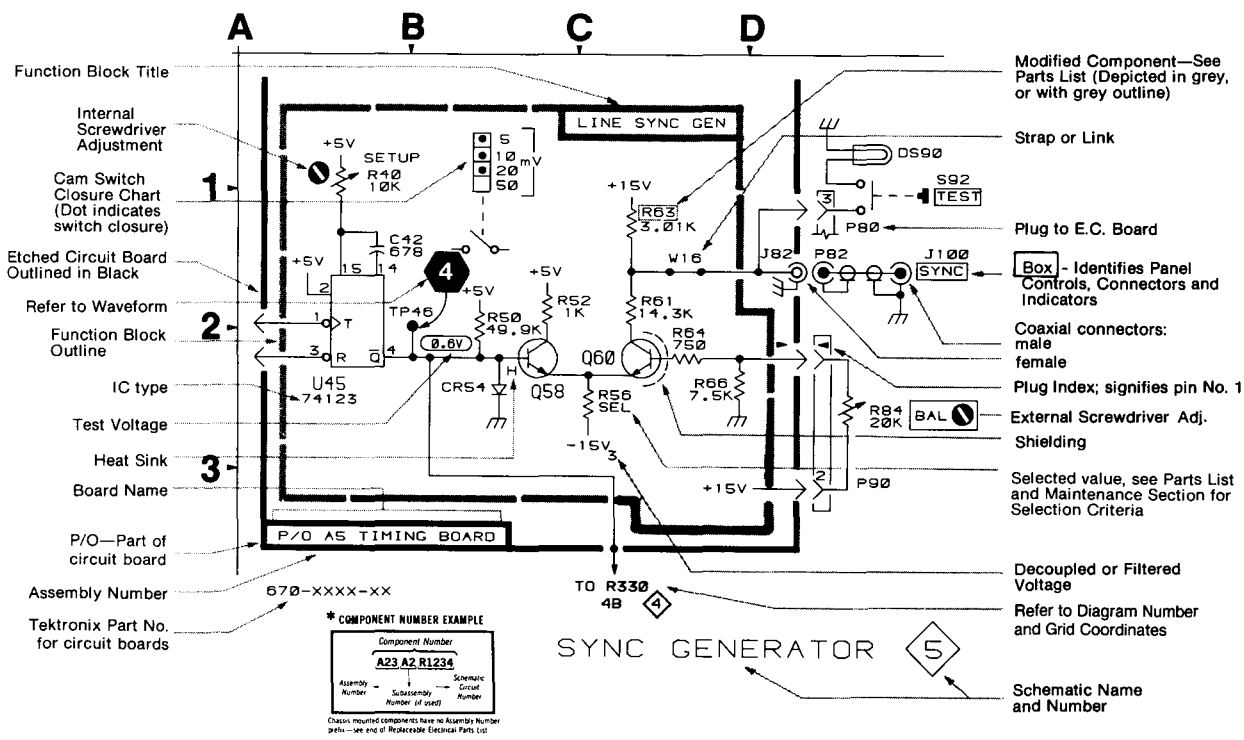
Capacitors = Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

The information and special symbols below may appear in this manual.

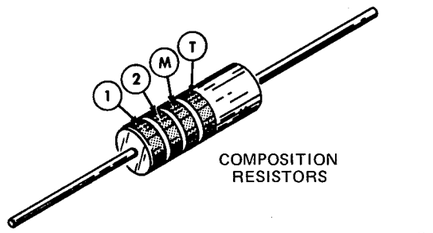
Assembly Numbers and Grid Coordinates

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).

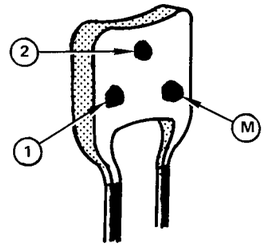
The schematic diagram and circuit board component location illustration have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used 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.



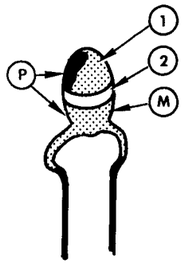
COLOR CODE



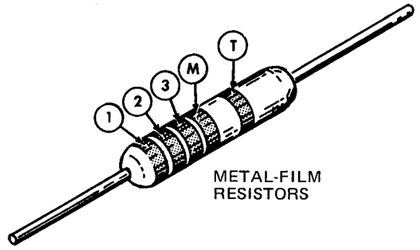
COMPOSITION RESISTORS



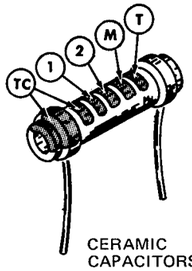
SMALL DISC CAPACITORS



DIPPED TANTALUM ELECTROLYTICS



METAL-FILM RESISTORS



CERAMIC CAPACITORS

(1)(2) and (3) — 1st, 2nd, and 3rd significant figures

(M) —multiplier (T) —tolerance

(TC) —temperature coefficient

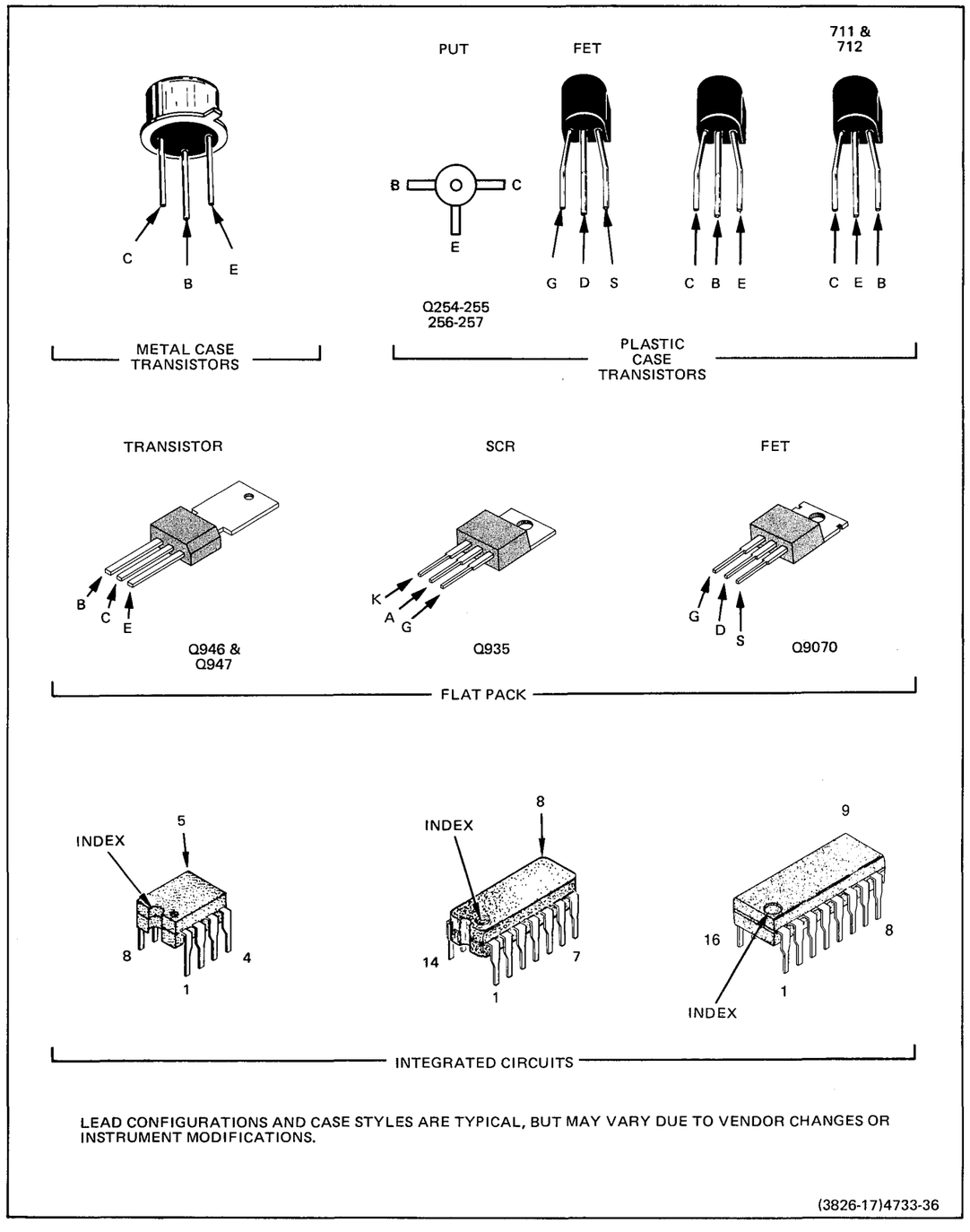
(P) —polarity and voltage rating

(T) and/or (TC) 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	10^2 or 100	±2%	10^2 or 100	±2%	———	10 VDC
ORANGE	3	10^3 or 1 K	±3%	10^3 or 1000	±3%	———	15 VDC
YELLOW	4	10^4 or 10 K	±4%	10^4 or 10,000	+100% −9%	———	20 VDC
GREEN	5	10^5 or 100 K	±½%	10^5 or 100,000	±5%	±0.5 pF	25 VDC
BLUE	6	10^6 or 1 M	±¼%	10^6 or 1,000,000	———	———	35 VDC
VIOLET	7	———	±1/10%	———	———	———	50 VDC
GRAY	8	———	———	10^{-2} or 0.01	+80% −20%	±0.25 pF	———
WHITE	9	———	———	10^{-1} or 0.1	±10%	±1 pF	———
GOLD	—	10^{-1} or 0.1	±5%	———	———	———	———
SILVER	—	10^{-2} or 0.01	±10%	———	———	———	———
NONE	—	———	±20%	———	±10%	±1 pF	———

(1861-20A)4733-35

Figure 9-1. Color codes for resistors and capacitors.



LEAD CONFIGURATIONS AND CASE STYLES ARE TYPICAL, BUT MAY VARY DUE TO VENDOR CHANGES OR INSTRUMENT MODIFICATIONS.

(3826-17)4733-36

Figure 9-2. Semiconductor lead configurations.

Circuit Number

e circuit board with its illustration and locate component by area and shape on the illustra-

le adjacent to the Circuit Board Illustration and cuit Number of the desired component.

he Schematic Diagram Number in which the is located.

3. Locate the Component on the Schematic Diagram

a. 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).

b. Scan the Component Location Table adjacent to the schematic diagram and find the Circuit Number of the desired component.

c. Under the SCHEM LOCATION column, read the grid coordinates for the desired component.

d. Using the Circuit Number and grid coordinates, locate the component on the schematic diagram.

A6 CRT BOARD

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 10

C602	C632	Q668	R625
C603	C641		R626
C609	C643	R604	R627
C671	C651	R605	R630
C615		R608	R632
C616	Q606	R609	
C617	Q610	R610	
C618	Q615	R614	
C619	Q645	R616	
C624	Q656	R623	
C626	Q665	R624	

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 11

C670	Q670	R677	
C671	Q672	R679	
C673	Q673	R680	
C680			
C681	R671	U617	
P603	R673	U618	
P607	R674	U619	
Q669	R675		

CRT CIRCUIT DIAGRAM 10

COMPONENT LOCATION TABLE

A6 ASSEMBLY

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C602	2C	3C	Q656	2F	2B
C603	1C	1G	Q665	1G	1B
C609	4E	2E	Q668	2G	2B
C612	7C	3E			
C615	7C	3D	R604	4C	1E
C616	2C	3C	R605	5D	1E
C617	7D	3D	R608	4E	1D
C618	7E	3E	R609	4E	2D
C619	6E	3C	R610	7B	3E
C624	4F	3D	R614	7C	3D
C626	7G	2D	R616	1C	3D
C632	8G	1E	R623	4D	2E
C643	3D	4B	R625	7F	2D
C651	3E	3B	R626	7F	2D
			R627	7G	1D
			R630	4F	1D
Q605					
Q606	4E	2D			
Q610	7C	3D	TP624	3B	2D
Q615	7D	3D			
Q645	3E	3B	U615	1D	3C

CHASSIS MOUNTED PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
L635	51	CHASSIS	V635	6J	CHASSIS

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MANUAL BINDER

PULL OUT PAGE TABS FOR SCHEMATIC DIAGRAMS

CRT CIRCUIT 10

PARTIAL A6 CRT CIRCUIT BOARD

CRT CIRCUIT 10

Numeral and letter at signal lines to or from other diagrams indicates the grid coordinates on another schematic (for example: 4E)

To identify any component in a schematic diagram and to locate that component on its respective circuit board.

SCHEMATIC DIAGRAM NAME AND NUMBER

(3516-81)4733-37

ind Component

ine the Assembly the component is located in a corner e board outline.

for the Assembly cuit Number of the

n, read the grid

ic diagrams and circuit board illustrations.

rcuit Number

circuit board with its illustration and locate
mponent by area and shape on the illustra-

e adjacent to the Circuit Board Illustration and
it Number of the desired component.

e Schematic Diagram Number in which the
located.

3. Loc

a.

b.

A6 CRT BOARD

COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 10

C602	C632	Q668	R625
C603	C641		R626
C609	C643	R604	R627
C671	C651	R605	R630
C615		R608	R632
C616	Q606	R609	
C617	Q610	R610	
C618	Q615	R614	
C619	Q645	R616	
C624	Q656	R623	
C626	Q665	R624	

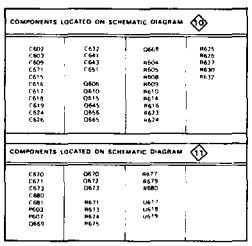
COMPONENTS LOCATED ON SCHEMATIC DIAGRAM 11

C670	Q670	R677	
C671	Q672	R679	
C673	Q673	R680	
C680			
C681	R671	U617	
P603	R673	U618	
P607	R674	U619	
Q669	R675		

COMPONENT LOCATION TABLE

CRT CIRCUIT DIAGRAM 10

A6 CRT BOARD



A6 ASSEMBLY

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C602	2C	3C	Q656	2F	2B
C603	1C	1G	Q665	1G	1B
C609	4E	2E	Q668	2G	2B
C612	7C	3E			
C615	7C	3D	R604	4C	1E
C616	2C	3C	R605	5D	1E
C617	7D	3D	R608	4E	1D
C618	7E	3E	R609	4E	2D
C619	6E	3C	R610	7B	3E
C624	4F	3D	R614	7C	3D
C626	7G	2D	R616	1C	3D
C632	8G	1E	R623	4D	2E
C643	3D	4B	R625	7F	2D
C651	3E	3B	R626	7F	2D
		3B	R627	7G	1D
			R630	4F	1D
Q606	4E	2D			
Q610	7C	3D	TP624	3B	2D
Q615	7D	3D			
Q645	3E	3B	U615	1D	3C

CHASSIS MOUNTED PARTS

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
L635	51	CHASSIS	V635	6J	CHASSIS

CRT CIRCUIT DIAGRAM 10

MANUAL BINDER

MANUAL BINDER

STRATION FOR
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RD LOCATION

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uit Number of the

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A

1

2

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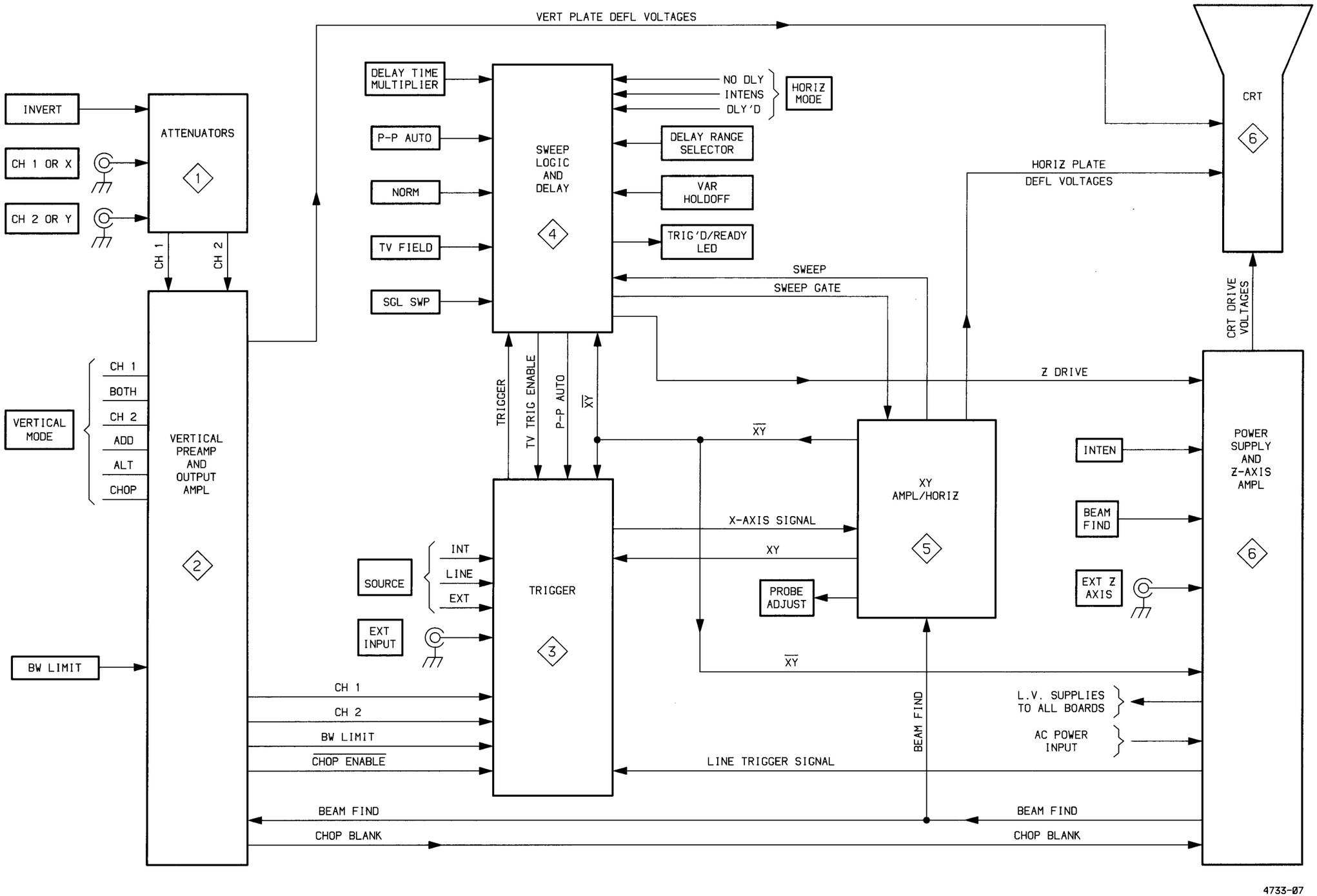
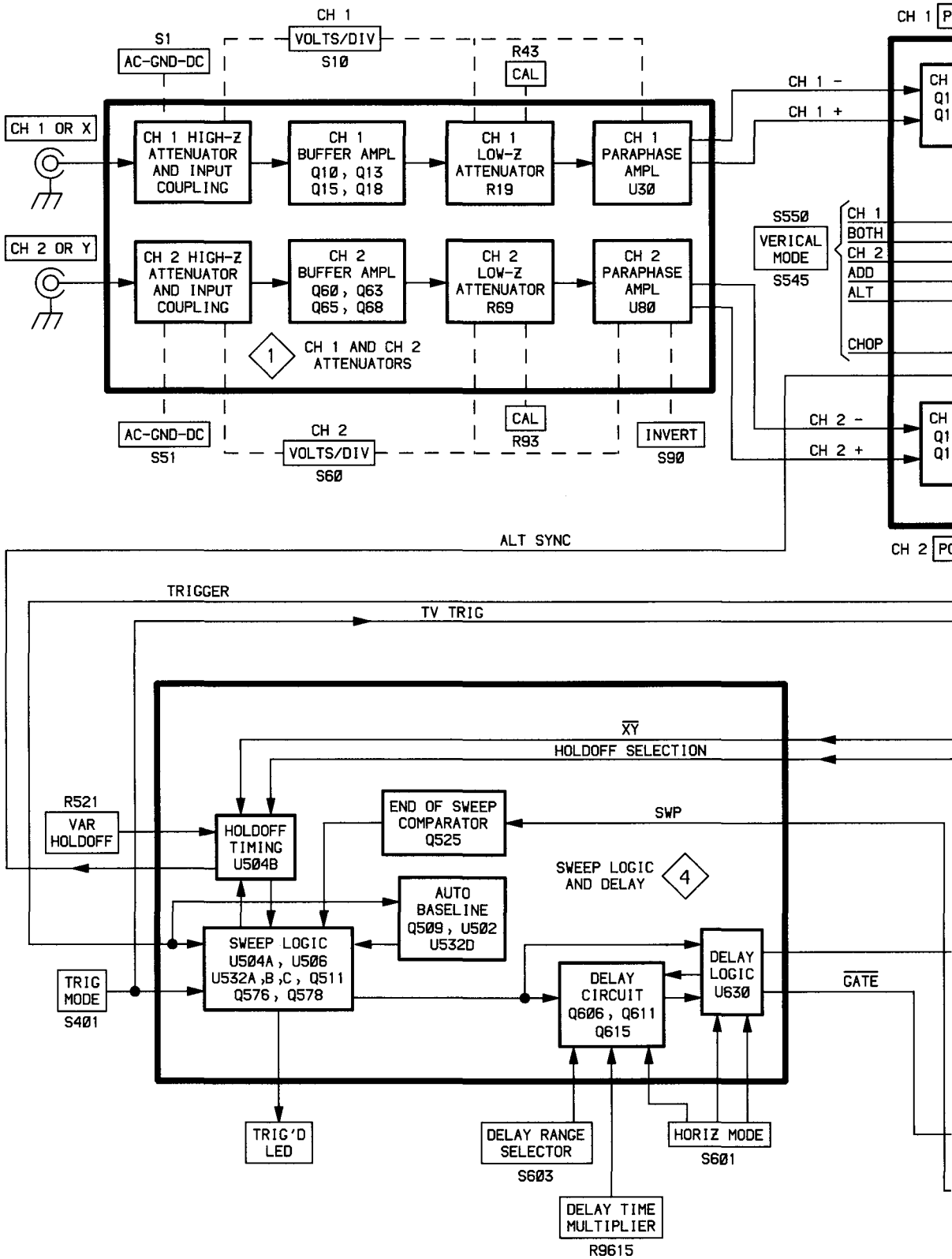


Figure 9-4. Basic block diagram.



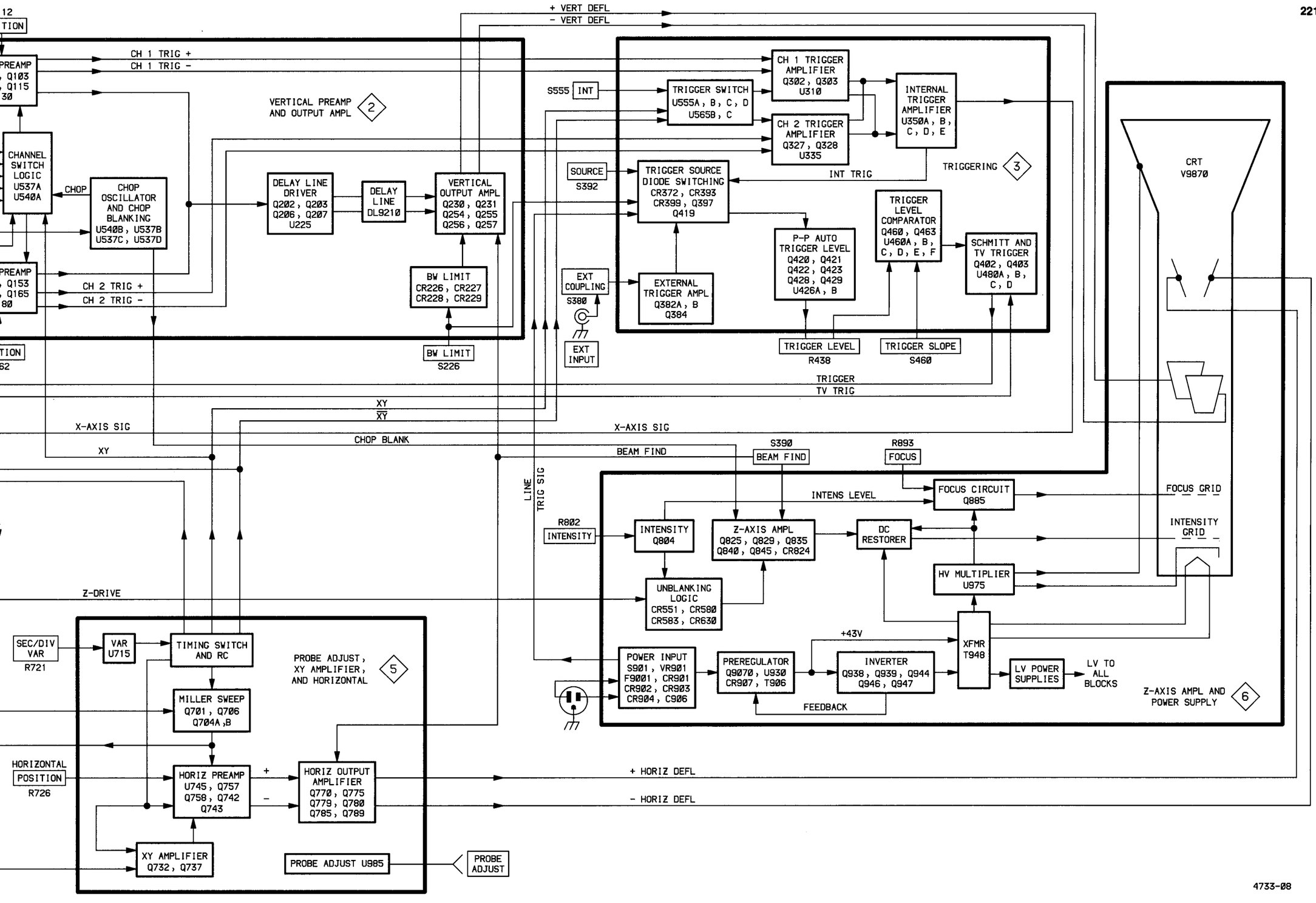
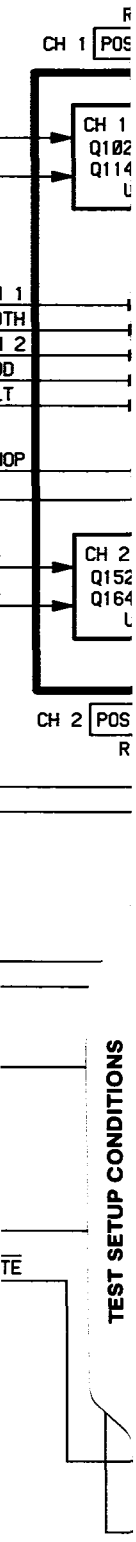


Figure 9-5. Detailed block diagram.



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	NO DLY
SEC/DIV	0.5 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
Range Selector	1.0 μs
MULTIPLIER	<X1

TRIGGER

VAR HOLDOFF	Minimum (fully ccw)
Mode	P-P AUTO
LEVEL	Midrange
INT	VERT MODE
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. Measurments are referenced to chassis ground with the exception of the Preregulator and Inverter voltages on Diagram 6. 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	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION
DL9210	2	5K	P9778	6	4P	Q9070	6	8J
			P9788	6	4P			
DS9150	6	8A	P9070-1	6	8J	R9100	1	1A
			P9070-2	6	8J	R9272	2	8S
F9001	6	5A	P9070-3	6	8J	R9273	2	2S
			P9870-10	6	4P	R9376	3	5A
FL9001	6	5A	P9870-12	6	3N	R9510	1	6A
			P9870-14	6	8P	R9521	4	3A
J9100	1	1A	P9870-1	6	8P	R9802A	6	2A
J9376	3	5A	P9870-2	6	8N	R9802B	6	3A
J9510	1	6A	P9870-3	6	7N			
J9800	6	4A	P9870-4	6	7N	V9870	6	2P
J9900	5	2E	P9870-5	6	6P			
			P9870-7	6	5P	W9272	2	8S
P9272	6	5P	P9870-8	6	7P			
P9273	6	5P						

W9700 (A1 TO A4)

WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	HORIZ POS	6,2F
2	XY	4,4E
3	XY	4,4D
4	HO 2	4,4D
5	HO 1	4,4D
6	HO COM	4,4D
7	A SWP	4,8P
8	GND	4,8P
9	A GATE	4,2P

P9700 (A4 TO A1)

PIN NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	HORIZ POS	6,2F
2	XY	4,4E
3	XY	4,4D
4	HO 2	4,4D
5	HO 1	4,4D
6	HO COM	4,4D
7	A SWP	4,8P
8	GND	4,8P
9	A GATE	4,2P

W9001 (A1 TO A3)

WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	BEAM FIND	6,4F
2	CH 1 POS CW	2,2D
3	CH 1 POS CCW	2,3D
4	INTENS LEVEL	6,3B
5	+8.6V_3	7,4P
6	CH 2 POS CW	2,8D
7	CH 2 POS CCW	2,8D
8	CH 2	2,9D
9	BW LIMIT	2,4K
10	CHOP ENABLE	2,4C
11	-8.6V_2	7,5P
12	CH 1	2,5C
13	NO PLUG-IN	4,3H
14	TV TRIG ENABLE	4,9B
15	XY	3,2C
16	A SLOPE	3,8P
17	A LEVEL	3,8M
18	HORIZ POS WIPER	5,2E
19	+ AUTO LEVEL CW	3,8L
20	- AUTO LEVEL CCW	3,9L

WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
21	P-P	4,9B
22	SS REQUEST	4,7B
23	DLUD	4,2H
24	INTENS	4,3H
25	TRIG'D LED	4,9L
26	SS	4,9B
27	0.5μs	4,5B
28	20μs	4,5B
29	0.5ms	4,4B
30	HO COM	4,4B
31	XY	3,4C
32	GND	3,6C
33	CH 1 T	3,2C
34	CH 2 T	3,2C
35	V MODE T	3,2C
36	EXT	3,7C
37	LINE	3,7C
38	INT	3,6C
39	GND	3,6C
40	EXT INPUT	3,5C

W9705 (A1 TO A4)

WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	GND	7,3N
2	+ SWP	5,6M
3	- SWP	5,2M
4	GND	7,3N
5	X AXIS	5,4D
6	−8.6V5	7,3N
7	+8.6V2	7,3N
8	+30V2	7,2N

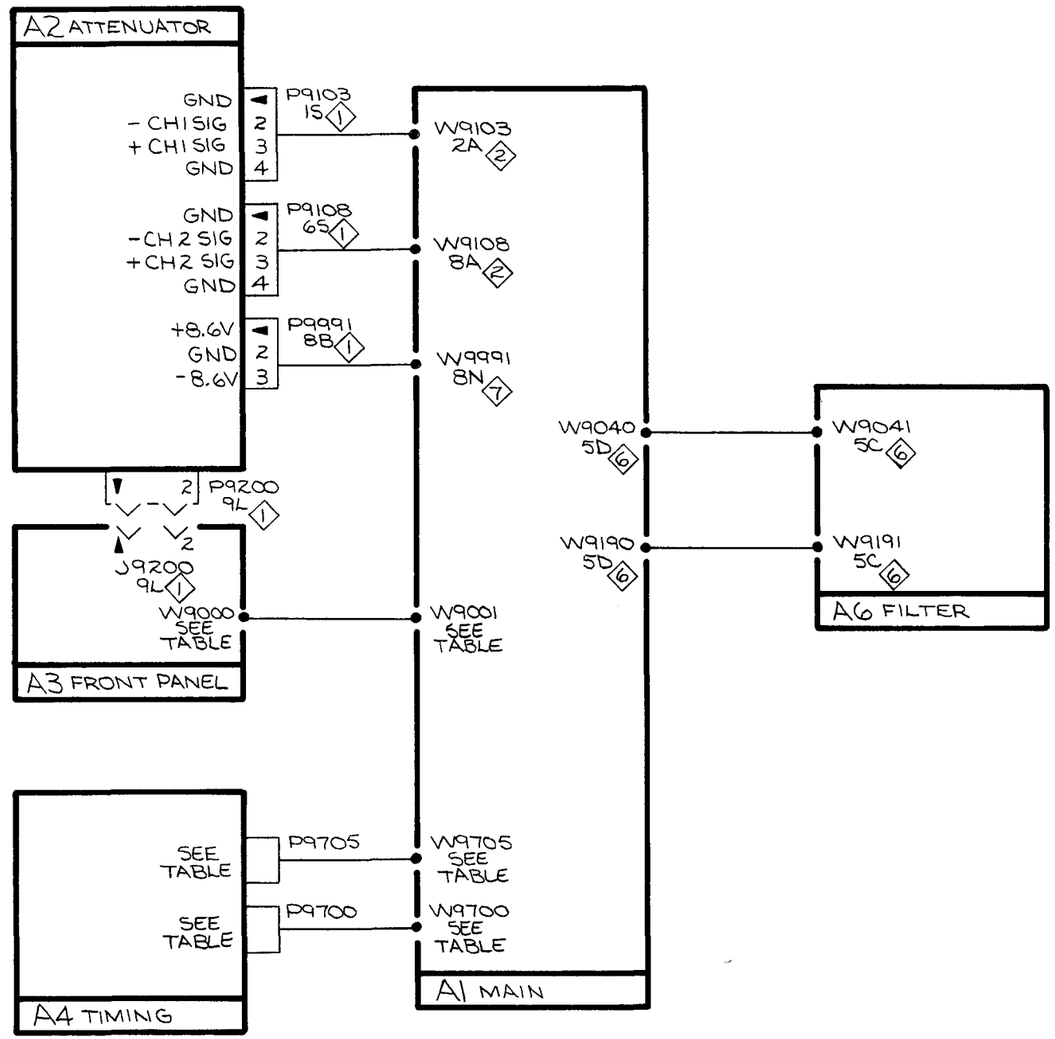
P9705 (A4 TO A1)

PIN NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	GND	7,3N
2	+ SWP	5,6M
3	- SWP	5,2M
4	GND	7,3N
5	X AXIS	5,4D
6	−8.6V5	7,3N
7	+8.6V2	7,3N
8	+30V2	7,2N

W9000 (A3 TO A1)

WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
1	BEAM FIND	6,4F
2	CH 1 POS CW	2,2D
3	CH 1 POS CCW	2,3D
4	INTENS LEVEL	6,3B
5	+8.6V3	7,4P
6	CH 2 POS CW	2,8D
7	CH 2 POS CCW	2,8D
8	CH 2	2,9D
9	BW LIMIT	2,4K
10	CHOP ENABLE	2,4C
11	−8.6V2	7,5P
12	CH 1	2,5C
13	NO PLUG-IN	4,3H
14	TV TRIG ENABLE	4,9B
15	XY	3,2C
16	A SLOPE	3,8P
17	A LEVEL	3,8M
18	HORIZ POS WIPER	5,2E
19	+ AUTO LEVEL CW	3,8L
20	- AUTO LEVEL CCW	3,9L

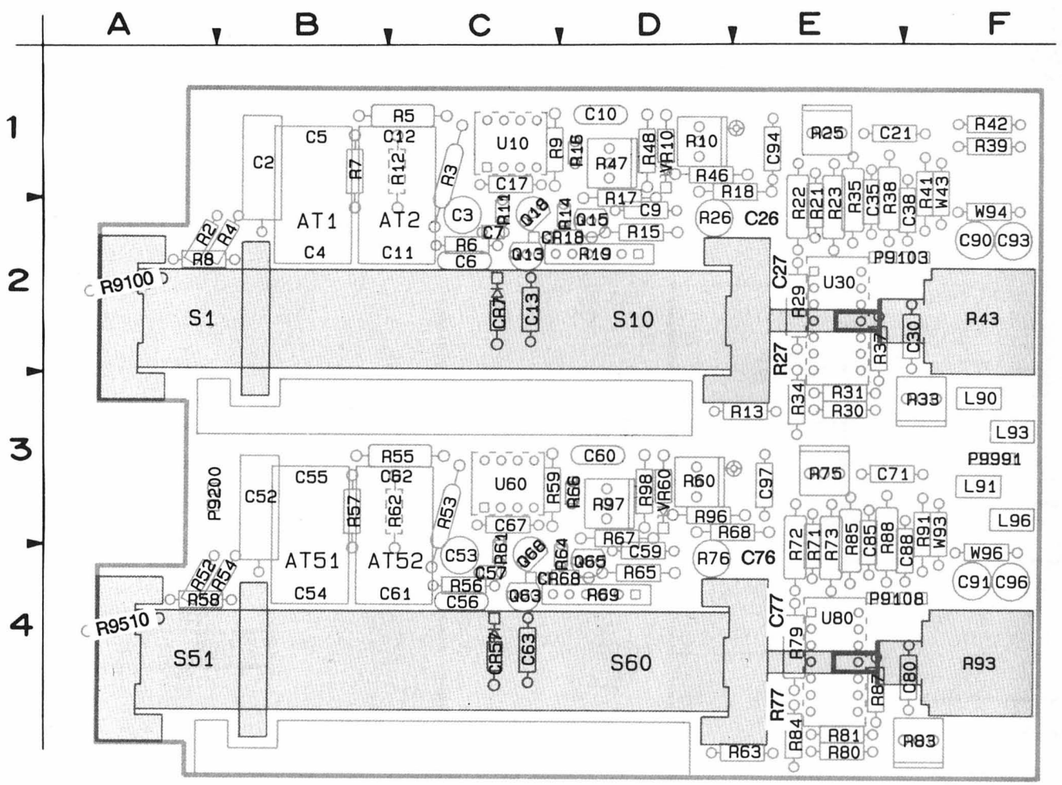
WIRE NO.	LINE NAME	DIAG NO. & GRID COORDINATES
21	P-P	4,9B
22	SS REQUEST	4,7B
23	DLUD	4,2H
24	INTENS	4,3H
25	TRIG'D LED	4,9L
26	SS	4,9B
27	0.5μs	4,5B
28	20μs	4,5B
29	0.5ms	4,4B
30	HO COM	4,4B
31	XY	3,4C
32	GND	3,6C
33	CH 1 T	3,2C
34	CH 2 T	3,2C
35	V MODE T	3,2C
36	EXT	3,7C
37	LINE	3,7C
38	INT	3,6C
39	GND	3,6C
40	EXT INPUT	3,5C



2213A

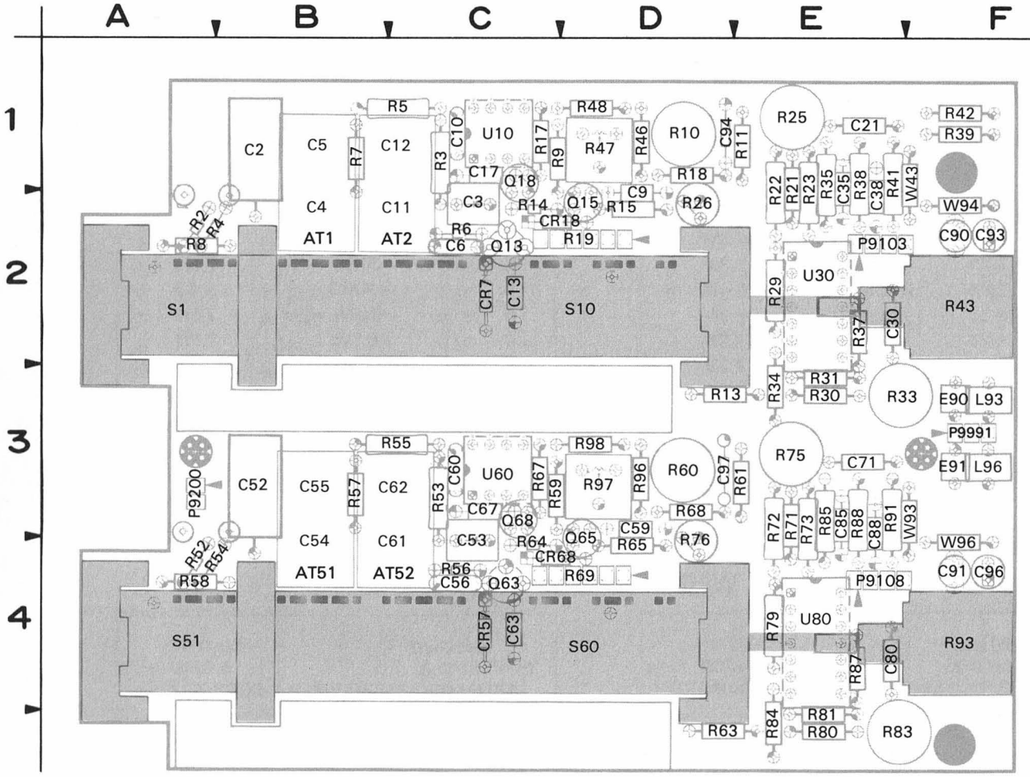
CIRCUIT BOARD INTERCONNECTIONS

4733-24



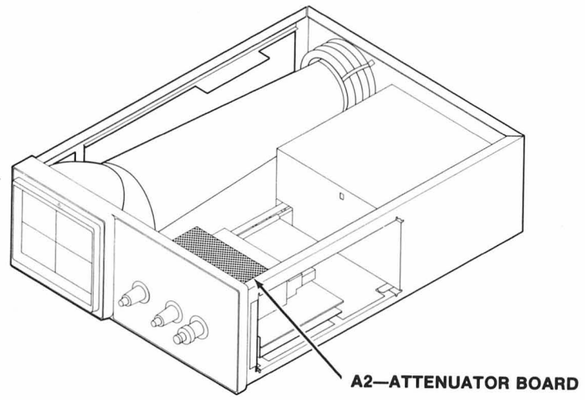
4733-39

Figure 9-6A. A2-Attenuator board (SN B020967 & above).



4733-14

Figure 9-6B. A2-Attenuator board (SN B020966 & below).



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.

A2—ATTENUATOR BOARD **FIG. 9-6**

CH 1 & CH 2 ATTENUATORS ◇1

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	2B	C94	3H	1E	R8	2B	2A	R63	5G	4E
AT2	2E	2C	C96	9B	4F	R9	2G	1D	R64	6G	4D
AT51	6D	4B	C97	7H	3E	R10	3G	1D	R65	7G	4D
AT52	6E	4C				R11*	3G	2C	R66*	7G	3D
			CR7	1G	2C	R12*	E2	1C	R67	6H	D3
C2	2B	1B	CR18	2H	2D	R13	1G	3E	R68	6H	3E
C3	2F	2C	CR57	6G	4C	R14	2H	2D	R69	6J	4D
C4	2D	2B	CR68	6H	4D	R15	2G	2D	R71	7L	4E
C5	2D	1B				R16*	2G	1D	R72	7L	4E
C6	1G	2C	E90*	8B	3F	R17	1H	1D	R73	7L	4E
C7*	2G	2C	E91*	8B	3F	R18	2H	1E	R75	7L	3E
C9	2G	2D				R19	1J	2D	R76	7M	4D
C10	3G	1D	L90*	8B	3F	R21	3L	2E	R77*	7N	4E
C11	2E	2C	L91*	8B	3F	R22	3M	2E	R79	7N	4E
C12	2E	1C	L93	9B	3F	R23	2M	2E	R80	7M	4E
C13	1H	2C	L96	9B	3F	R25	2M	1E	R81	8N	4E
C17	2H	1C				R26	3M	2D	R83	8M	4F
C21	2L	1E	P9103-1	2S	2E	R27*	2N	2E	R84	8N	4E
C26*	3N	2E	P9103-2	2S	2E	R29	2N	2E	R85	9N	4E
C27*	3N	2E	P9103-3	3S	2E	R30	3M	3E	R87	8N	4E
C30	3M	2F	P9103-4	3S	2E	R31	3N	3E	R88	9P	4E
C35	5N	2E	P9108-1	7S	4E	R33	3M	3F	R91	9M	3F
C38	4P	2F	P9108-2	6S	4E	R34	4N	3E	R93	9M	4F
C52	6B	3B	P9108-3	8S	4E	R35	5N	2E	R96	7H	3D
C53	6F	4C	P9108-4	7S	4E	R37	4P	2E	R97	8H	3D
C54	6D	4B	P9200-1	9L	3A	R38	4P	2E	R98	8H	3D
C55	6D	3B	P9200-2	9L	3A	R39	4P	1F			
C56	6G	4C	P9991-1	8B	3F	R41	4P	2F	S1	4B	2A
C57*	6G	4C	P9991-2	9B	3F	R42	5P	1F	S10	4H	2D
C59	7G	4D	P9991-3	9B	3F	R43	5P	2F	S51	5B	4A
C60	7G	3D				R46	3H	1D	S60	5H	4D
C61	6E	4C	Q13	1H	2C	R47	3H	1D			
C62	6E	3C	Q15	2H	2D	R48	3H	1D	U10	2F	1C
C63	6H	4C	Q18	2H	2C	R52	6A	4A	U30	1N	2E
C67	6H	3C	Q63	6H	4C	R53	6F	3C	U60	6F	3C
C71	7L	3E	Q65	7G	4D	R54	6B	4B	U80	6N	4E
C76*	7N	4E	Q68	6H	4C	R55	7F	3C			
C77*	7N	4E				R56	6G	4C	VR10*	8D	1D
C80	8M	4F	R2	2A	2A	R57	6D	3B	VR60*	8E	3D
C85	9N	4E	R3	2F	1C	R58	6B	4A			
C88	9P	4F	R4	2B	2B	R59	7G	3C	W43	5P	2F
C90	8B	2F	R5	2F	1C	R60	7G	3D	W93	9M	3F
C91	8B	4F	R6	2G	2C	R61*	7G	4C	W94	9C	2F
C93	9B	2F	R7	2D	1B	R62*	6E	3C	W96	9C	4F

ASSEMBLY A3

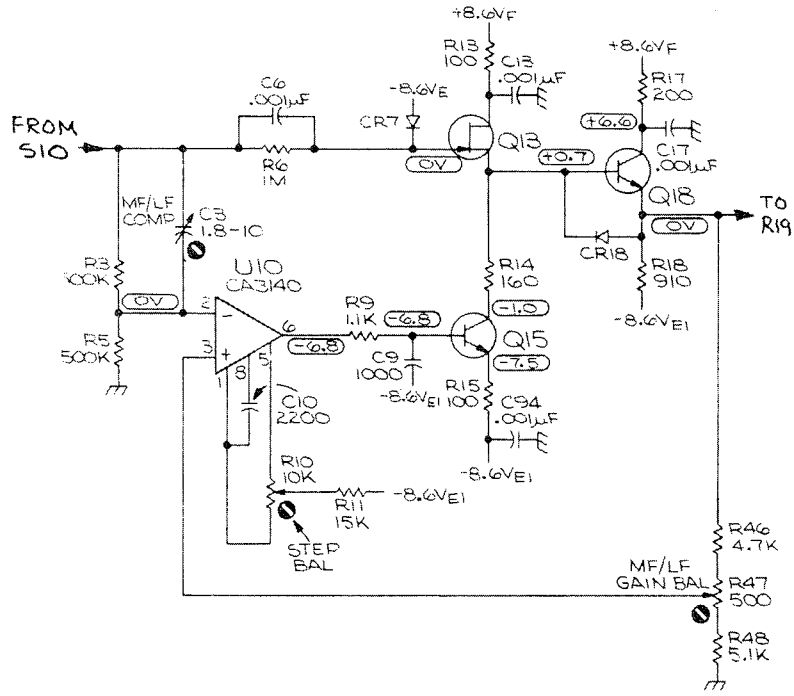
R89	9K	2C	R92	9K	1C	S90	9K	2C			

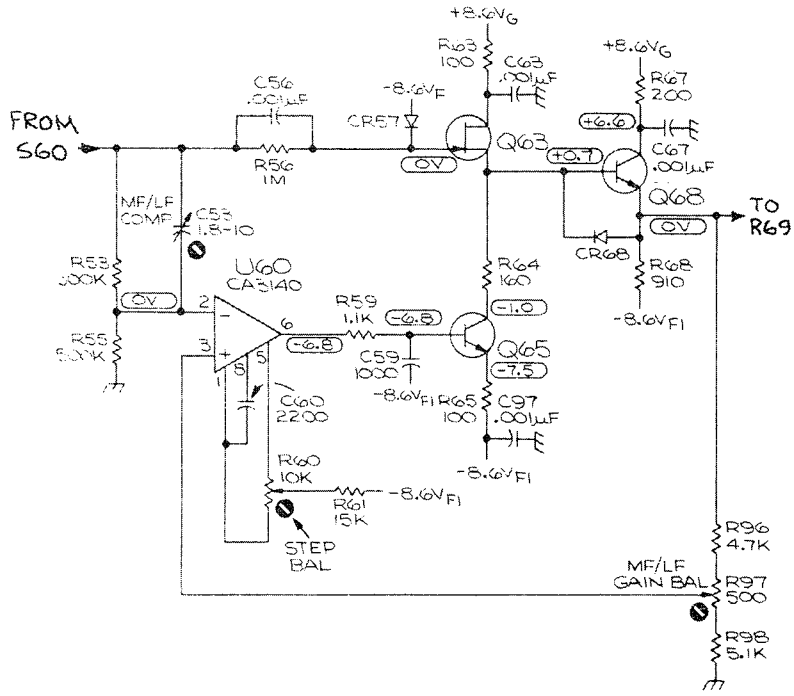
Partial A3 also shown on diagrams 2, 3, 4, 5, 6, and 7.

CHASSIS PARTS

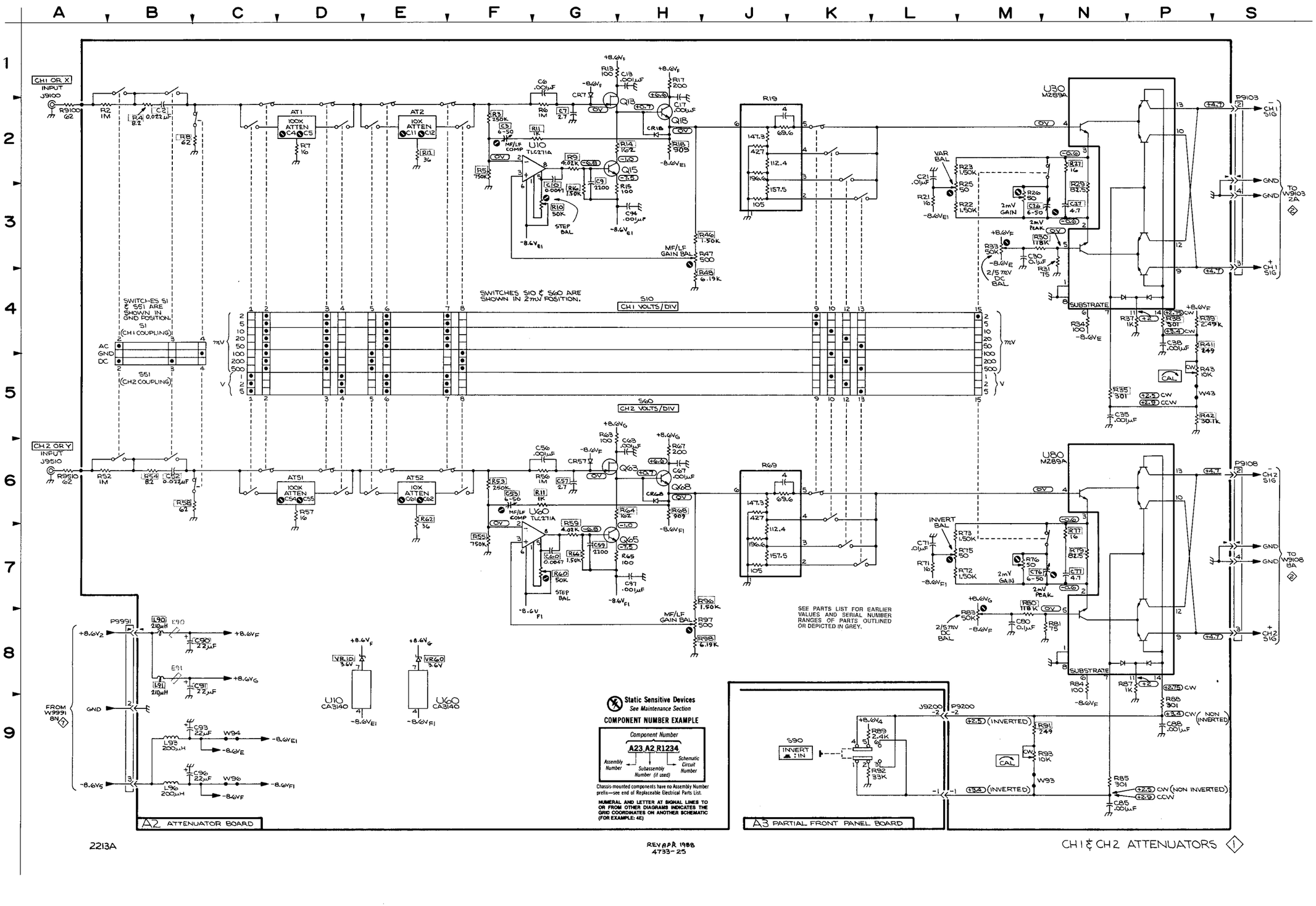
J9100	1A	--	J9510	6A	--	R9100	1A	2A	R9510	6A	4A

***See Parts List for serial number ranges.**





EFF: SN B020966 & BELOW.



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CH1 & CH2 ATTENUATORS ⟨1⟩

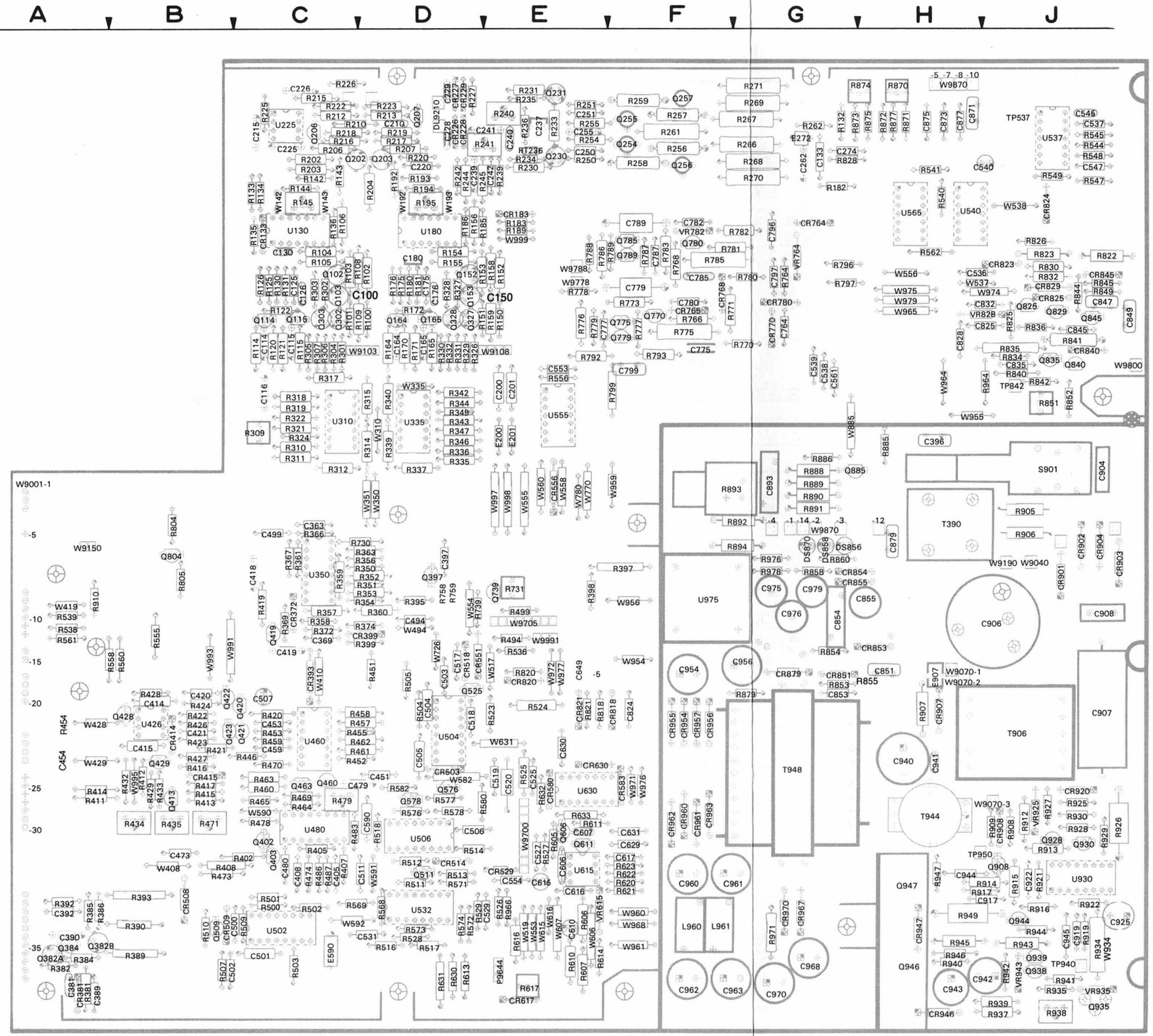

Figure 9-7. A1—Main board.

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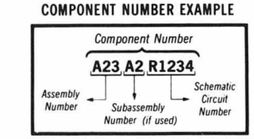
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

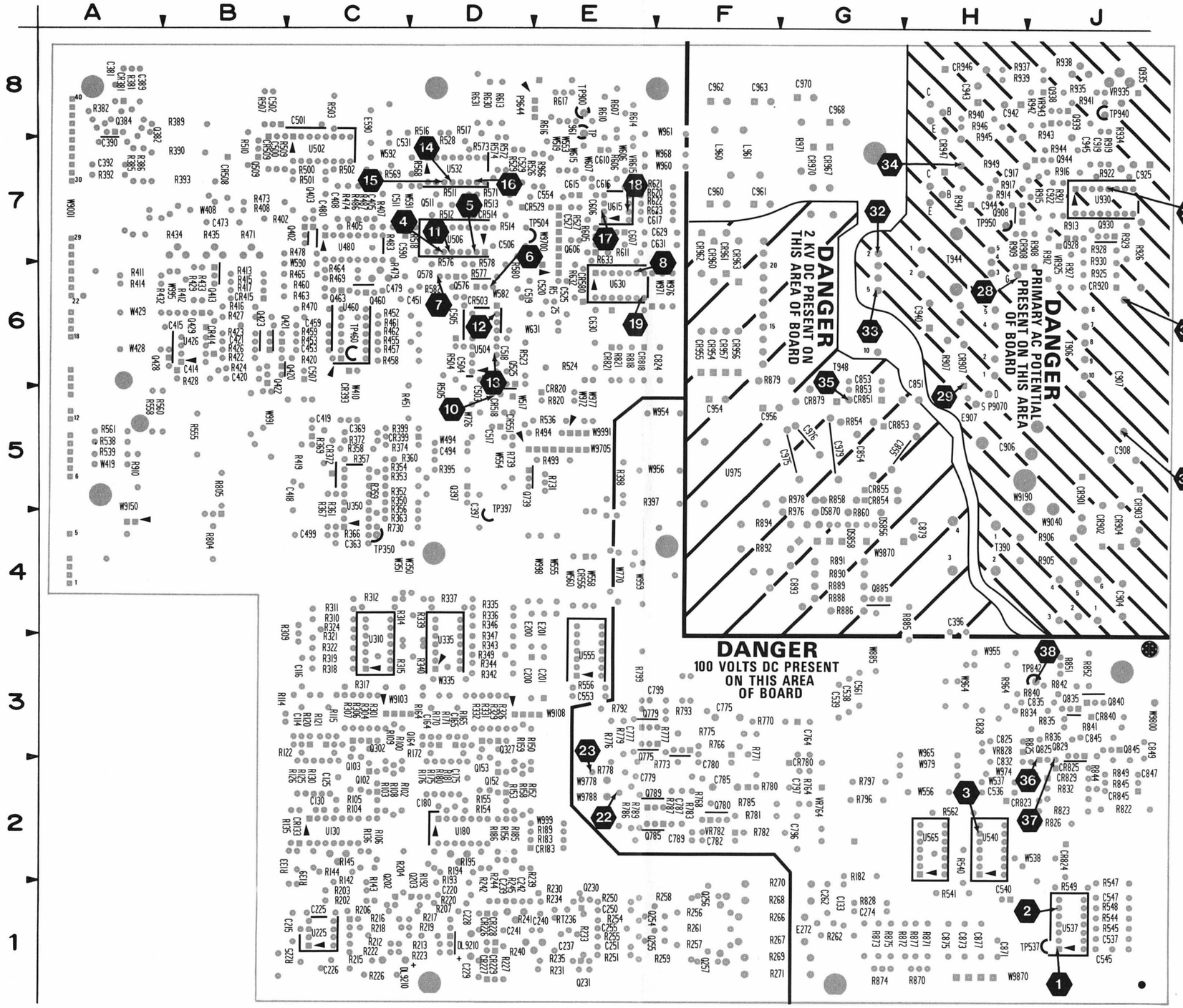
A1—MAIN BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C100	2										
C114	2	C540	2	CR229	2	Q152	2	R121	2	R255	2
C115	2	C545	2	CR372	3	Q153	2	R122	2	R256	2
C116	2	C547	2	CR381	3	Q164	2	R125	2	R257	2
C125	2	C553	3	CR393	3	Q165	2	R126	2	R258	2
C126	2	C554	4	CR399	3	Q202	2	R130	2	R259	2
C130	2	C561	2	CR414	3	Q203	2	R131	2	R261	2
C133	2	C590	7	CR415	3	Q206	2	R132	2	R262	2
C150	2	C606	4	CR503	4	Q207	2	R133	2	R266	2
C164	2	C607	4	CR508	4	Q230	2	R135	2	R267	2
C165	2	C610	4	CR509	4	Q231	2	R136	2	R268	2
C175	2	C615	4	CR514	4	Q254	2	R139	2	R269	2
C176	2	C616	4	CR518	4	Q255	2	R142	2	R270	2
C180	2	C617	4	CR529	4	Q256	2	R143	2	R271	2
C200	7	C629	4	CR551	6	Q257	2	R144	2	R301	3
C201	7	C630	4	CR556	3	Q302	3	R145	2	R302	3
C210	2	C631	4	CR580	6	Q303	3	R150	2	R303	3
C215	2	C764	5	CR583	6	Q327	3	R151	2	R304	3
C220	7	C775	5	CR617	4	Q328	3	R152	2	R305	3
C225	2	C777	5	CR630	6	Q382	3	R153	2	R306	3
C226	2	C779	5	CR764	5	Q382	3	R154	2	R307	3
C228	2	C780	5	CR765	5	Q384	3	R155	2	R309	3
C229	2	C782	5	CR768	5	Q397	3	R156	2	R310	3
C237	2	C785	5	CR770	5	Q402	3	R158	2	R311	3
C239	2	C787	5	CR780	5	Q403	3	R159	2	R312	3
C240	2	C789	5	CR818	6	Q413	3	R164	2	R314	3
C241	2	C796	7	CR820	6	Q419	3	R165	2	R315	3
C242	2	C797	7	CR821	6	Q420	3	R170	2	R317	3
C250	2	C799	7	CR823	6	Q421	3	R171	2	R318	3
C251	2	C824	6	CR824	6	Q422	3	R172	2	R319	3
C255	2	C825	6	CR825	6	Q423	3	R175	2	R321	3
C262	2	C828	6	CR829	6	Q428	3	R176	2	R322	3
C274	7	C832	6	CR840	6	Q429	3	R180	2	R324	3
C363	3	C835	6	CR845	6	Q460	3	R181	2	R326	3
C369	3	C845	6	CR851	6	Q463	3	R182	2	R327	3
C381	3	C847	6	CR853	6	Q509	4	R183	2	R328	3
C389	3	C849	6	CR854	6	Q511	4	R185	2	R329	3
C390	3	C851	6	CR855	6	Q525	4	R186	2	R330	3
C392	3	C853	6	CR879	6	Q576	4	R189	2	R331	3
C396	6	C854	6	CR901	6	Q578	4	R192	2	R332	3
C397	3	C855	6	CR902	6	Q606	4	R193	2	R335	3
C405	3	C871	6	CR903	6	Q611	4	R194	2	R336	3
C408	3	C873	6	CR904	6	Q739	3	R195	2	R337	3
C414	3	C875	6	CR907	6	Q770	5	R202	2	R339	3
C415	3	C877	6	CR908	6	Q775	5	R203	2	R340	3
C418	3	C879	6	CR920	6	Q779	5	R204	2	R342	3
C419	3	C893	6			Q780	5	R206	2	R343	3
C420	3	C904	6	CR946	6	Q785	5	R207	2	R344	3
C421	3	C906	6	CR947	6	Q789	5	R210	2	R346	3
C451	7	C907	6	CR954	6	Q804	6	R212	2	R347	3
C453	3	C908	6	CR955	6	Q825	6	R213	2	R349	3
C454	3	C917	6	CR956	6	Q829	6	R215	2	R350	3
C459	3	C919	6	CR957	6	Q835	6	R216	2	R351	3
C473	3	C922	6	CR960	6	Q840	6	R217	2	R352	3
C479	3	C925	6	CR961	6	Q845	6	R218	2	R353	3
C480	3	C940	6	CR962	6	Q885	6	R219	2	R354	3
C494	7	C941	6	CR963	6	Q908	6	R220	7	R356	3
C499	7	C942	6	CR967	6	Q928	6	R222	2	R357	3
C500	4	C943	6	CR970	6	Q930	6	R223	2	R358	3
C501	4	C944	6	DS856	6	Q935	6	R225	2	R359	3
C502	4	C945	6	DS858	6	Q938	6	R226	2	R360	3
C503	4	C954	6	DS870	6	Q939	6	R227	2	R361	3
C504	4	C956	6	E200	7	Q944	6	R230	2	R363	3
C505	4	C960	6	E201	7	Q946	6	R231	2	R366	3
C506	4	C961	6	E272	7	Q947	6	R233	2	R367	3
C507	7	C962	6	E590	7	R100	2	R234	2	R369	3
C511	4	C963	6	E907	6	R101	2	R235	2	R372	3
C517	4	C968	6	P9644	4	R102	2	R236	2	R374	3
C518	4	C970	6	Q102	2	R103	2	R239	2	R381	3
C519	4	C975	6	Q103	2	R104	2	R240	2	R382	3
C520	4	C976	6	Q114	2	R105	2	R241	2	R384	3
C525	4	C979	6	Q115	2	R106	2	R242	2	R385	3
C527	4	CR133	2			R108	2	R244	2	R386	3
C529	4	CR183	2			R109	2	R245	2	R389	3
C531	4	CR226	2			R114	2	R250	2	R390	3
C536	2	CR227	2			R115	2	R251	2	R392	3
C537	2	CR228	2			R120	2	R254	2	R393	3
C538	2										
C539	2										

TABLE (cont)

A1—MAIN BOARD (cont)

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
R395	3	R528	4	R818	6	R949	6	W592	7		
R397	6	R529	4	R820	6	R964	7	W606	4	W9103	2
R398	6	R536	4	R821	6	R966	7	W607	4	W9108	2
R399	3	R538	2	R822	6	R971	6	W615	4	W9150	6
R402	3	R539	2	R823	6	R976	6	W616	4	W9700-1	5
R405	3	R540	2	R825	6	R978	6	W631	7	W9700-2	4
R407	3	R541	2	R826	6	RT236	2	W726	5	W9700-3	4
R408	3	R544	2	R828	6	S901	6	W770	5	W9700-4	4
R411	3	R545	2	R830	6	T390	6	W780	5	W9700-5	4
R412	3	R547	2	R832	6	T906	6	W934	6	W9700-6	4
R413	3	R548	2	R834	6	T944	6	W954	7	W9700-7	4
R414	3	R549	2	R835	6	T948	6	W955	7	W9700-8	4
R415	3	R555	3	R836	6	TP350	3	W956	7	W9700-9	4
R416	3	R556	3	R840	6	TP397	3	W959	7	W9705-1	7
R417	3	R558	3	R841	6	TP460	3	W960	7	W9705-2	5
R419	3	R560	3	R842	6	TP504	4	W961	7	W9705-3	5
R420	3	R561	2	R844	6	TP537	2	W964	7	W9705-4	7
R421	3	R562	3	R845	6	TP842	6	W965	7	W9705-5	5
R422	3	R568	4	R849	6	TP900	6	W968	7	W9705-6	7
R423	3	R569	4	R851	6	TP940	6	W971	7	W9705-7	7
R424	3	R571	4	R852	6	TP950	6	W972	7	W9705-8	7
R426	3	R572	4	R853	6	TP961	7	W974	7	W9870	6
R427	3	R573	4	R854	6	U130	2	W975	7	W9991	7
R428	3	R574	4	R855	6	U180	2	W976	7		
R429	3	R576	4	R858	6	U225	2	W977	7		
R432	3	R577	4	R860	6	U310	3	W979	7		
R433	3	R578	4	R870	6	U335	3	W991	7		
R434	3	R580	4	R871	6	U350	3	W993	7		
R435	3	R582	4	R872	6	U426	3	W995	7		
R446	3	R605	4	R873	6	U460	3	W997	7		
R451	7	R606	4	R874	6	U480	3	W998	7		
R452	3	R607	4	R875	6	U502	4	W999	7		
R453	3	R610	4	R877	6	U504	4	W9040	6		
R454		R611	4	R879	6	U506	4	W9190	6		
R455	3	R613	4	R885	6	U532	4	W9778	5		
R457	3	R614	4	R886	6	U537	2	W9788	5		
R458	3	R616	4	R888	6	U540	2	W9800	6		
R459	3	R617	4	R889	6	U555	3	W9001-10	2		
R460	3	R620	4	R890	6	U565	3	W9001-11	7		
R461	3	R621	4	R891	6	U615	4	W9001-12	2		
R462	3	R622	4	R892	6	U630	4	W9001-13	4		
R463	3	R623	4	R893	6	U930	6	W9001-14	4		
R464	3	R630	4	R894	6	U975	6	W9001-15	3		
R465	3	R631	4	R905	6	VR615	4	W9001-16	3		
R469	3	R632	4	R906	6	VR764	5	W9001-17	3		
R470	3	R633	4	R907	6	VR782	5	W9001-18	5		
R471	3	R730	3	R908	6	VR828	6	W9001-19	3		
R473	3	R731	3	R909	6	VR925	6	W9001-1	6		
R474	3	R739	3	R910	6	VR935	6	W9001-20	3		
R478	3	R764	5	R912	6	VR943	6	W9001-21	4		
R479	3	R766	5	R913	6	W142	2	W9001-22	4		
R483	3	R768	5	R914	6	W143	2	W9001-23	4		
R486	3	R770	5	R915	6	W192	2	W9001-24	4		
R487	3	R771	5	R916	6	W193	2	W9001-25	4		
R494	7	R773	5	R917	6	W310	3	W9001-26	4		
R499	7	R775	5	R919	6	W335	3	W9001-27	4		
R500	4	R776	5	R921	6	W350	3	W9001-28	4		
R501	4	R777	5	R922	6	W351	3	W9001-29	4		
R502	4	R778	5	R925	6	W408	3	W9001-2	2		
R503	4	R779	5	R926	6	W410	3	W9001-30	4		
R504	4	R780	5	R927	6	W419	3	W9001-31	3		
R505	4	R781	5	R928	6	W428	3	W9001-32	3		
R507	4	R782	5	R929	6	W429	3	W9001-33	3		
R509	4	R783	5	R930	6	W494	7	W9001-34	3		
R510	4	R785	5	R934	6	W517	4	W9001-35	3		
R511	4	R786	5	R935	6	W519	4	W9001-36	3		
R512	4	R787	5	R937	6	W535	2	W9001-37	3		
R513	4	R788	5	R938	6	W537	2	W9001-38	3		
R514	4	R789	5	R939	6	W538	2	W9001-39	3		
R516	4	R792	5	R940	6	W553	3	W9001-3	2		
R517	4	R793	5	R941	6	W554	3	W9001-40	3		
R518	4	R796	7	R942	6	W555	3	W9001-4	6		
R523	4	R797	7	R943	6	W556	7	W9001-5	7		
R524	4	R799	7	R944	6	W558	3	W9001-6	2		
R525	4	R804	6	R945	6	W560	3	W9001-7	2		
R526	4	R805	6	R946	6	W582	4	W9001-8	2		
R527	4			R947	6	W590	7	W9001-9	2		
						W591	7				



CIRCUIT VIEW OF A1—MAIN BOARD
FIG. 9-8

Figure 9-8. Circuit view of A1—Main board.

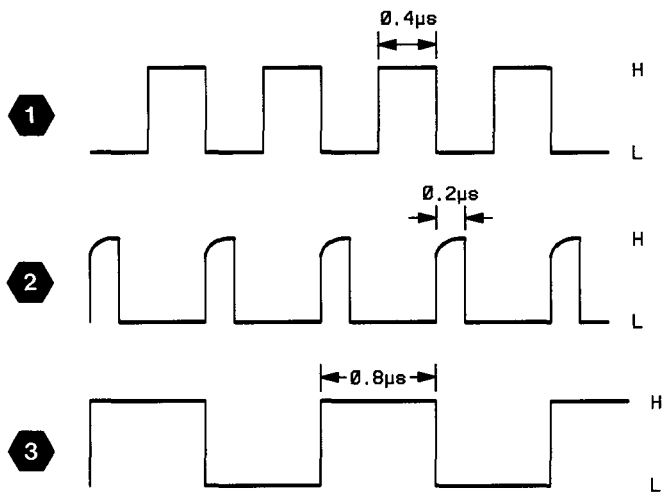
2213A CONTROL SETTINGS

DC Voltages

Input Coupling (both)	GND
VOLTS/DIV (both)	Ø.1V

AC Waveforms

VERTICAL MODE	BOTH, CHOP
TRIGGER Mode	P-P AUTO



4733-10

VERTICAL PREAMP & OUTPUT AMPL ◇2

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
C100*	2B	3C									
C114	2D	3C									
C115	3D	3C	Q206	4J	1C	R181	9F	3D	R269	4P	1G
C116	2E	3C	Q207	6J	1D	R182	6F	2G	R270	6P	2G
C125	3E	3C	Q230	7N	2E	R183	6F	2E	R271	5P	1G
C126	3F	3C	Q231	3N	1E	R185	7F	2D	R538	5E	5A
C130	3F	2C	Q254	7P	1F	R186	7F	2D	R539	6C	5A
C133	5F	2G	Q255	3P	1F	R189	6F	2E	R540	5E	2H
C150*	8B	3D	Q256	8P	2F	R192	8H	2D	R541	5E	2H
C164	8D	3D	Q257	2P	1F	R193	9H	2D	R544	5C	1J
C165	9D	3D				R194	8H	2D	R545	5C	1J
C175	9E	3D	R100	2A	3C	R195	9H	2D	R547	4D	2J
C176	9F	3D	R101	3A	3C	R202	5H	2C	R548	4D	2J
C180	9F	2D	R102	2B	2D	R203	5H	2C	R549	4E	2J
C210	5J	1D	R103	3B	2C	R204	5H	2D	R561	4C	5A
C215	5J	1C	R104	2B	2C	R206	4H	2C			
C225	8J	2C	R105	3B	2C	R207	6J	2D	RT236	5N	2E
C226	4K	1C	R106	2B	2C	R210	5J	1C			
C228	4L	1D	R108	2B	2C	R212	5J	1C	TP537	4D	1J
C229	3L	1D	R109	3B	3C	R213	5J	1D			
C237	5N	1E	R114	2D	3C	R215	5J	1C	U130	1F	2C
C239	5M	2D	R115	3D	3C	R216	4J	1C	U180	9F	2D
C240	5M	1E	R120	2E	3C	R217	6J	1D	U225	7J	1C
C241	6M	1D	R121	3E	3C	R218	4J	1C	U537A	5D	1J
C242	5M	2D	R122	3E	3C	R219	6J	1D	U537B	4E	1J
C250	7N	2E	R125	2E	3C	R222	5K	1C	U537C	5D	1J
C251	3N	1E	R126	2E	3C	R223	5K	1D	U537D	5C	1J
C255	3N	1E	R130	2F	3C	R225	7J	1C	U540A	5E	2H
C262	5P	2G	R131	3F	3C	R226	4L	1C	U540B	5C	2H
C536	5D	3H	R132	5F	1G	R227	4M	1D			
C537	8K	1J	R133	5F	2C	R230	7M	2E	W142	2G	2C
C538	5D	3G	R135	4F	2C	R231	3M	1E	W143	3G	2C
C539	6D	3G	R136	4F	2C	R233	5N	1E	W192	8G	2D
C540	8J	2H	R139	5G	2C	R234	6M	2E	W193	9G	2D
C545	5C	1J	R142	2H	2C	R235	4M	1E	W535	5D	7F
C547	4D	2J	R143	4H	2C	R236	5N	1E	W537	5D	3H
C561	5D	3G	R144	2H	2C	R239	5M	2E	W538	5E	2J
			R145	3H	2C	R240	5M	1E	W9001-10	4C	5A
CR133	5F	2C	R150	8B	3E	R241	5M	1D	W9001-12	5C	5A
CR183	5F	2E	R151	9B	3D	R242	5M	2D	W9001-2	2D	4A
CR226	4L	1D	R152	8B	2E	R244	5L	2D	W9001-3	3D	4A
CR227	4L	1D	R153	9B	2D	R245	6L	2D	W9001-6	8D	5A
CR228	4L	1D	R154	8B	2D	R250	7N	2E	W9001-7	8D	5A
CR229	4L	1D	R155	9B	2D	R251	3N	1E	W9001-8	6C	5A
			R156	9B	2D	R254	7N	1E	W9001-9	4K	5A
Q102	2B	2C	R158	9B	2D	R255	3N	1E	W9103-1	2A	3C
Q103	3B	3C	R159	9B	3D	R256	8P	2F	W9103-2	3A	3C
Q114	2E	3C	R164	8D	3D	R257	2P	1F	W9103-3	2A	3C
Q115	3E	3C	R165	9D	3D	R258	7P	2F	W9103-4	3A	3C
Q152	8B	2D	R170	9E	3D	R259	3P	1F	W9108-1	8A	3D
Q153	9B	3D	R171	9D	3D	R261	5P	1F	W9108-2	9A	3D
Q164	8E	3D	R172	9E	3D	R262	5P	1G	W9108-3	8A	3D
Q165	9E	3D	R175	9E	3D	R266	7P	1G	W9108-4	9A	3D
Q202	5H	2C	R176	8F	3D	R267	3P	1G			
Q203	6J	2D	R180	8F	3D	R268	6P	2G			

Partial A1 also shown on diagrams 3, 4, 5, 6 and 7.

ASSEMBLY A3

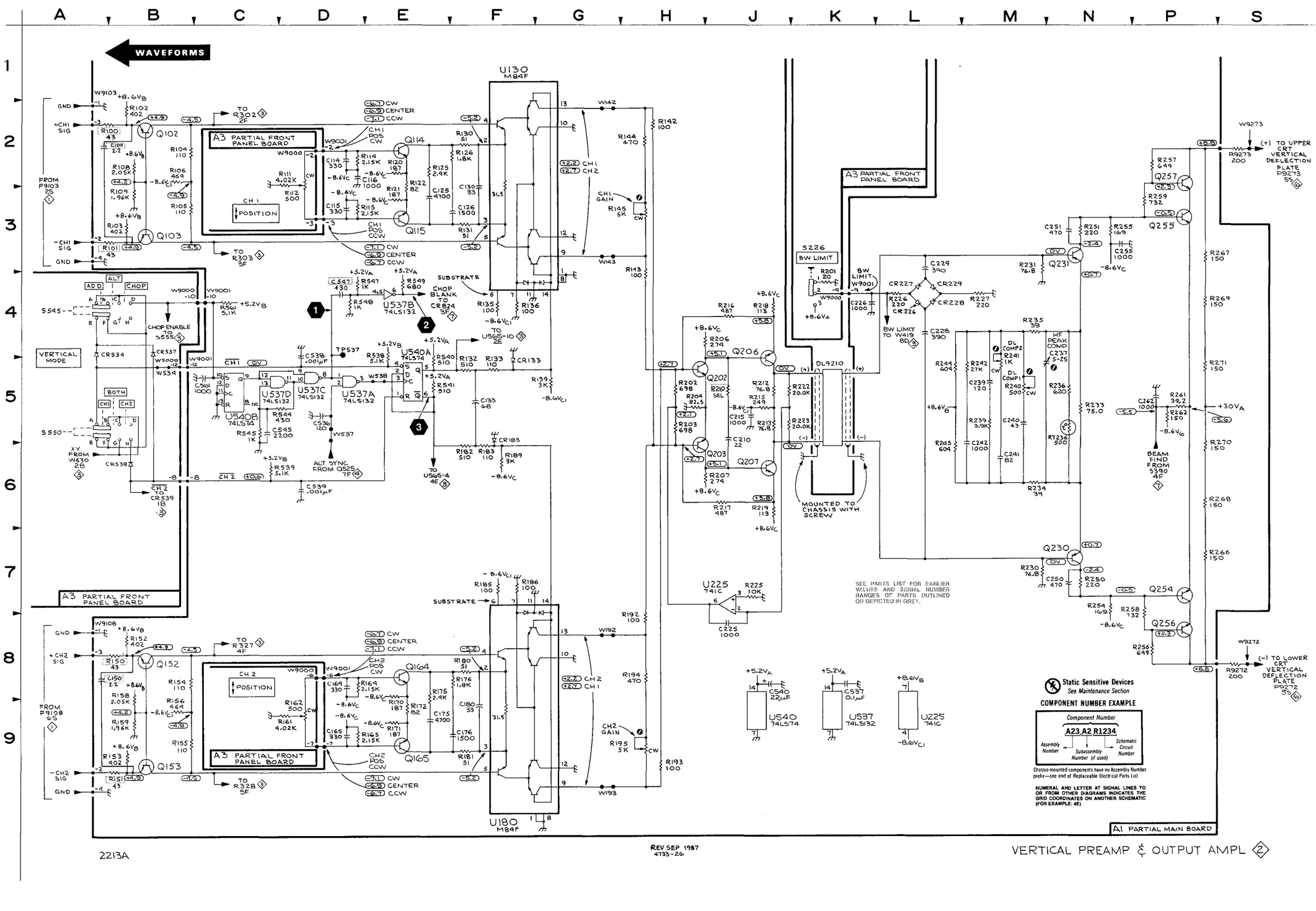
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
CR534	5A	2B	R111	2D	1B	S545	4A	2D	W9000-3	3D	4A
CR537	5B	2B	R112	2D	1B	S550	5A	2B	W9000-6	8D	4A
CR538	2B	2B	R161	9C	2C				W9000-7	9D	4B
			R162	9C	2C	W534	5B	4C	W9000-8	6B	4B
J9200-1	9K	3C	R201	4K	2C	W9000-10	4C	4B	W9000-9	4K	4B
J9200-2	9K	3C				W9000-12	5B	4C			
			S226	4K	2C	W9000-2	2D	4A			

Partial A3 also shown on diagrams 1, 3, 4, 5, 6 and 7.

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
DL9210	5K	CHASSIS	R9272	8S	CHASSIS	W9272	8S	CHASSIS			
			R9273	2S	CHASSIS	W9273	2S	CHASSIS			

***See Pa serial nu**



List for
er ranges.

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VERTICAL PREAMP & OUTPUT AMPL 2

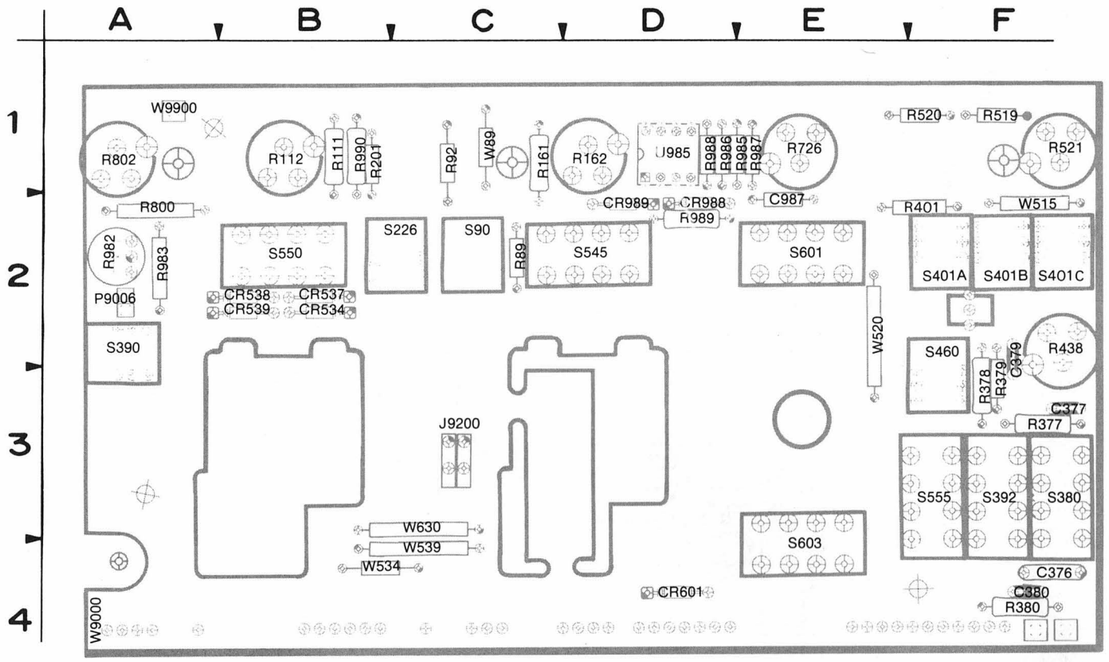


Figure 9-9. A3—Front panel board.

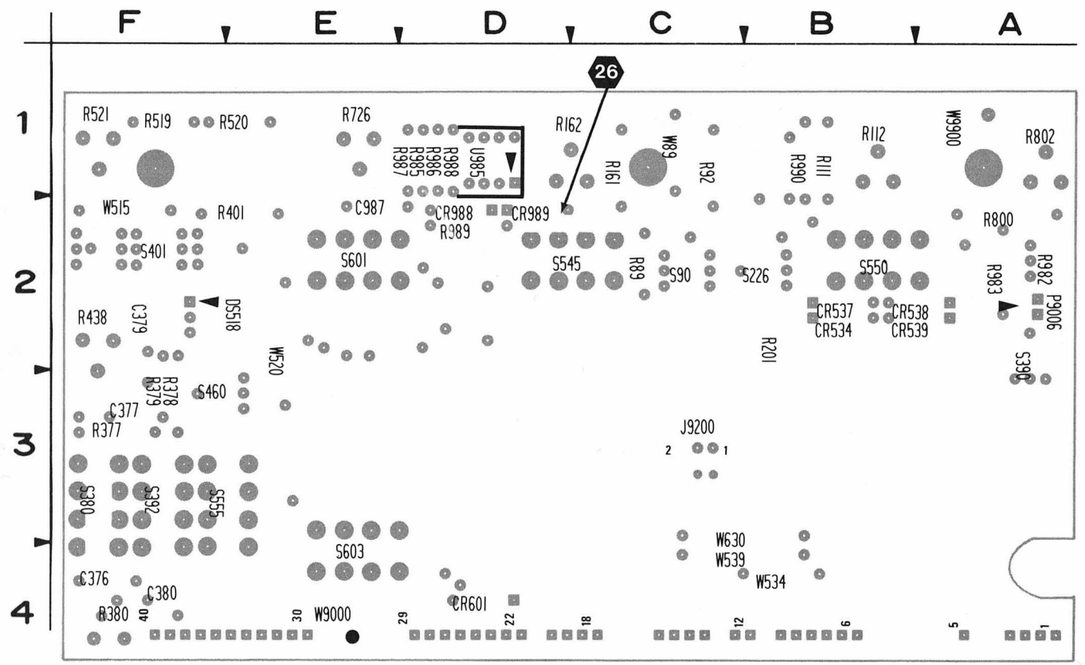


Figure 9-10. Circuit view of A3—Front panel board.

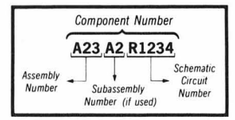
A3—FRONT PANEL BOARD FIG. 9-9, -10

A3—FRONT PANEL BOARD

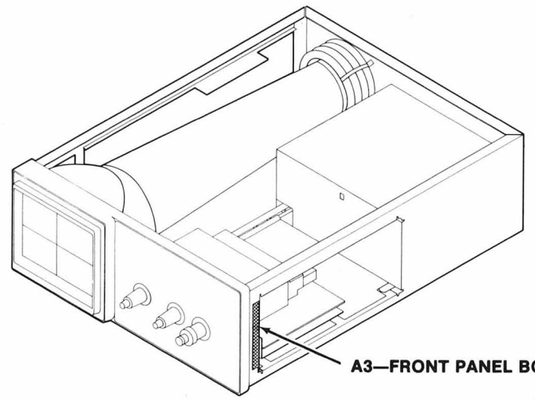
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C376	3	R983	6	W9000-17	3
C377	3	R985	5	W9000-18	5
C379	3	R986	5	W9000-19	3
C380	3	R987	5	W9000-1	6
C987	5	R988	5	W9000-20	3
CR534	2	R989	5	W9000-21	4
CR537	2	R990	5	W9000-22	4
CR538	2	S90	1	W9000-23	4
CR539	3	S226	2	W9000-24	4
CR601	3	S380	3	W9000-25	4
CR988	5	S390	6	W9000-26	4
CR989	5	S392	3	W9000-27	4
J9200-1	2			W9000-28	4
J9200-2	2			W9000-29	4
P9006-1	6	S401	4	W9000-2	2
P9006-2	6	S460	3	W9000-30	4
R89	1	S545	2	W9000-31	3
R92	1	S550	2	W9000-32	3
R111	2	S555	3	W9000-33	3
R112	2	S601	4	W9000-34	3
R161	2	S603	4	W9000-35	3
R162	2	U985	5	W9000-36	3
R201	2	W89	7	W9000-37	3
R377	3	W515	4	W9000-38	3
R378	3	W520	4	W9000-39	3
R379	3	W534	2	W9000-3	2
R380	3	W539	3	W9000-40	3
R401	4	W630	3	W9000-4	6
R438	3	W9000-10	2	W9000-5	7
R519	4	W9000-11	7	W9000-6	2
R520	4	W9000-12	2	W9000-7	2
R521	4	W9000-13	4	W9000-8	2
R726	5	W9000-14	4	W9000-9	2
R800	6	W9000-15	3	W9900	5
R982	6	W9000-16	3		

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



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	R307	3G	3C	R399	6E	5C	TP350	2L	5C
C369	7F	5C	R309	2G	4C	R402	5N	7C	TP397	6E	5D
C381	5C	8A	R310	2G	4C	R405	5P	7C	TP460	7J	6C
C389	6D	8A	R311	2G	4C	R407	5P	7C	U310	1G	4C
C390	4E	8A	R312	2H	4C	R408	5N	7B	U335	4H	4D
C392	7D	7A	R314	3J	4C	R411	8H	7A	U350A	1L	5C
C397	6F	4D	R315	1J	3D	R412	9H	6B	U350B	3M	5C
C405	5P	7C	R317	1F	3C	R413	9H	7B	U350C	3L	5C
C408	5P	7C	R318	1G	3C	R414	8H	7A	U350D	3K	5C
C414	8J	6B	R319	2J	4C	R415	9J	7B	U350E	1K	5C
C415	9J	6B	R321	3J	4C	R416	8J	6B	U426A	8K	6B
C418	8E	5C	R322	3J	4C	R417	9J	6B	U426B	9K	6B
C419	7F	5C	R324	3H	4C	R419	8F	5C	U460A	7L	6C
C420	7J	6B	R326	5G	3D	R420	7G	6C	U460B	7L	6C
C421	9K	6B	R327	4G	3D	R421	9J	6B	U460C	7L	6C
C453	7M	6C	R328	5G	3D	R422	8J	6B	U460D	7K	6C
C454*	7N	6A	R329	4G	3D	R423	9J	6B	U460E	7K	6C
C459	7N	6C	R330	6G	3D	R424	7J	6B	U460F	7K	6C
C473	4P	7B	R331	4G	3D	R426	8J	6B	U480A	6P	7C
C479	6M	6C	R332	5G	3D	R427	9J	6B	U480B	5S	7C
C480	1P	7C	R335	5H	4D	R428	8K	6B	U480C	5L	7C
C553	3P	3E	R336	5H	4D	R429	9K	7B	U480D	5M	7C
CR372	7G	5C	R337	5H	4D	R432	9K	6B	U555A	2D	4E
CR381	5C	8A	R339	6J	4D	R433	9K	7B	U555B	1E	4E
CR393	7F	6C	R340	4J	3D	R434	9K	7B	U555C	3E	4E
CR399	7F	5C	R342	3F	3D	R435	9K	7B	U555D	3E	4E
CR414	8J	6B	R343	3G	4D	R446	7M	6C	U565B	3F	2H
CR415	9J	6B	R344	5J	4D	R452	8K	6C	U565C	2F	2H
CR556	2D	4E	R346	6J	4D	R453	7L	6C			
			R347	6J	4D	R454*	7M	6C	W310	1J	4D
Q302	2G	3C	R349	6H	4D	R455	8L	6C	W335	4J	3D
Q303	3G	3C	R350	1K	5C	R457	6K	6C	W350	1K	4D
Q327	5G	3D	R351	3K	5C	R458	7L	6C	W351	3K	4D
Q328	6G	3D	R352	2K	5C	R459	7N	6C	W408	5N	7B
Q382A	5D	8A	R353	2K	5C	R460	4K	7C	W410	7G	6C
Q382B	5D	8A	R354	2K	5C	R461	7P	6C	W419	8E	5A
Q384	5E	8A	R356	1L	5C	R462	7P	6C	W428	8K	6A
Q397	6F	5D	R357	3L	5C	R463	4L	6C	W429	9K	6A
Q402	5N	7C	R358	2K	5C	R464	5L	7C	W553	4C	8E
Q403	5N	7C	R359	2L	5C	R465	5M	7C	W554	2D	5D
Q413	9J	7B	R360	3L	5D	R469	5M	7C	W555	2D	4E
Q419	8F	5C	R361	3K	5C	R470	5L	6C	W558	3D	4E
Q420	7J	6C	R363	1L	5C	R471	5L	7B	W560	3D	4E
Q421	9J	6C	R366	3L	5C	R473	6P	7B	W9001-15	2C	6A
Q422	8J	6B	R367	4M	5C	R474	6N	7C	W9001-16	8P	6A
Q423	9K	6B	R369	7F	5C	R478	5N	7C	W9001-17	8M	6A
Q428	8K	6B	R372	7G	5C	R479	6M	7C	W9001-19	8L	6A
Q429	9K	6B	R374	7G	5C	R483	6M	7C	W9001-20	9L	6A
Q460	4K	7C	R381	5C	8A	R486	5S	7C	W9001-31	4C	8A
Q463	4L	7C	R382	5D	8A	R487	6P	7C	W9001-32	6C	8A
Q739	2M	5D	R384	5D	8A	R555	1C	5B	W9001-33	2C	8A
			R385	5E	8A	R556	1D	3E	W9001-34	3C	8A
R301	2G	3C	R386	6D	8A	R558	2C	6A	W9001-35	3C	8A
R302	2G	3C	R389	6D	8B	R560	3C	6B	W9001-36	7C	8A
R303	3G	3C	R390	4D	8B	R562	2E	2H	W9001-37	7C	8A
R304	2G	3C	R392	7D	7A	R730	2M	5D	W9001-38	6C	8A
R305	3G	3C	R393	7E	7B	R731	2M	5E	W9001-39	6C	8A
R306	1G	3C	R395	6F	5D	R739	2M	5D	W9001-40	5C	8A

Partial A1 also shown on diagrams 2, 4, 5, 6 and 7.

***See Parts serial num**

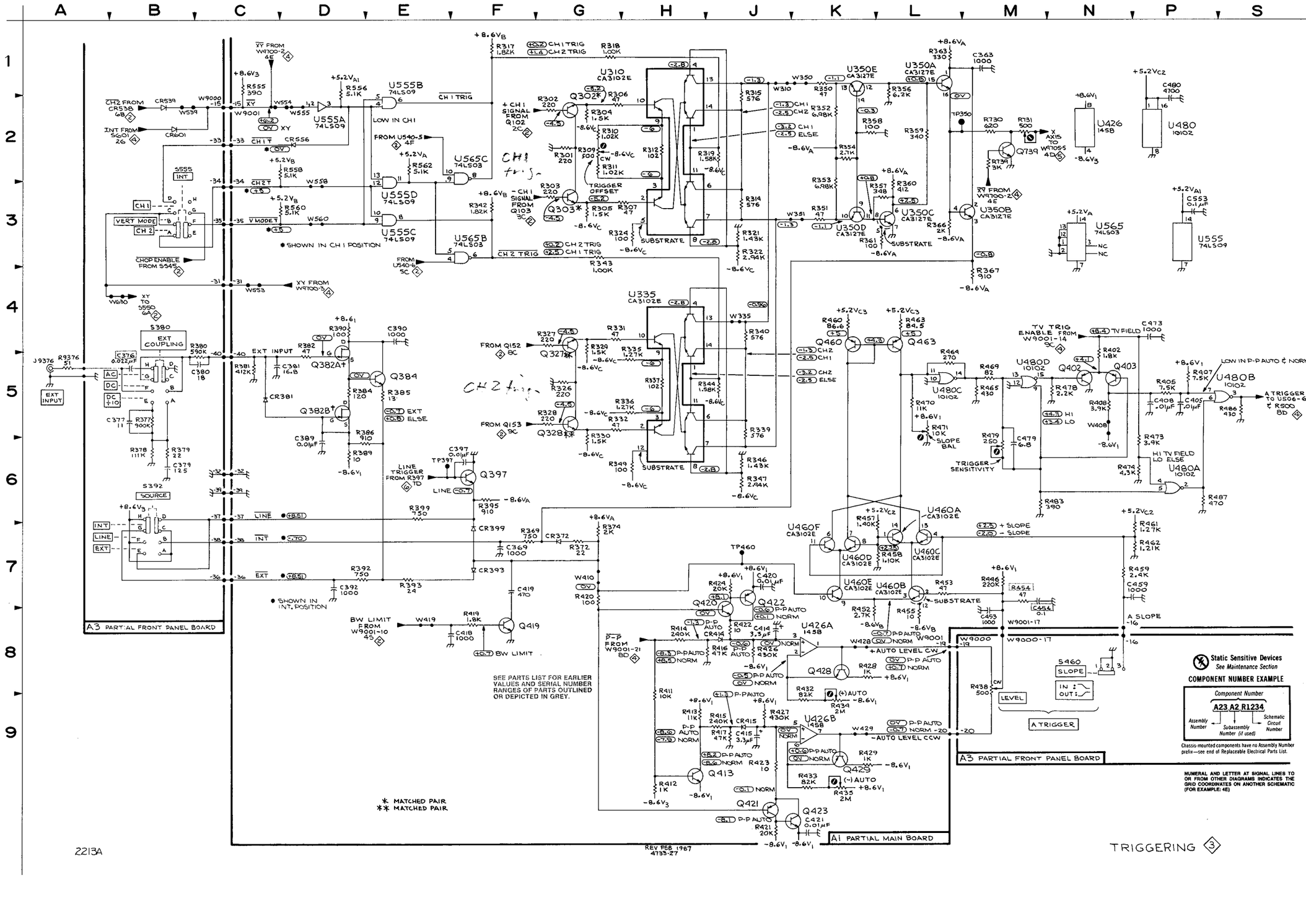
ASSEMBLY A3

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	4G	R378	6B	3G	W539	2B	4C	W9000-33	2C	4F
C377	5B	3G	R379	6B	3G	W630	4B	4C	W9000-34	3C	4F
C379	6B	2G	R380	5C	4G	W9000-15	2C	4C	W9000-35	3C	4F
C380	5C	4G	R438	9M	3G	W9000-16	8P	4C	W9000-36	7C	4F
						W9000-17	8M	4C	W9000-37	7C	4G
CR539	2B	2B	S380	5B	3G	W9000-19	8M	4D	W9000-38	7C	4G
CR601	2B	1E	S392	7B	3G	W9000-20	9M	4D	W9000-39	6C	4G
			S460	8N	3F	W9000-31	6C	4F	W9000-40	6C	4G
R377	5B	3G	S555	3B	3F	W9000-32	6C	4F			

Partial A3 also shown on diagrams 1, 2, 4, 5, 6 and 7.

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						



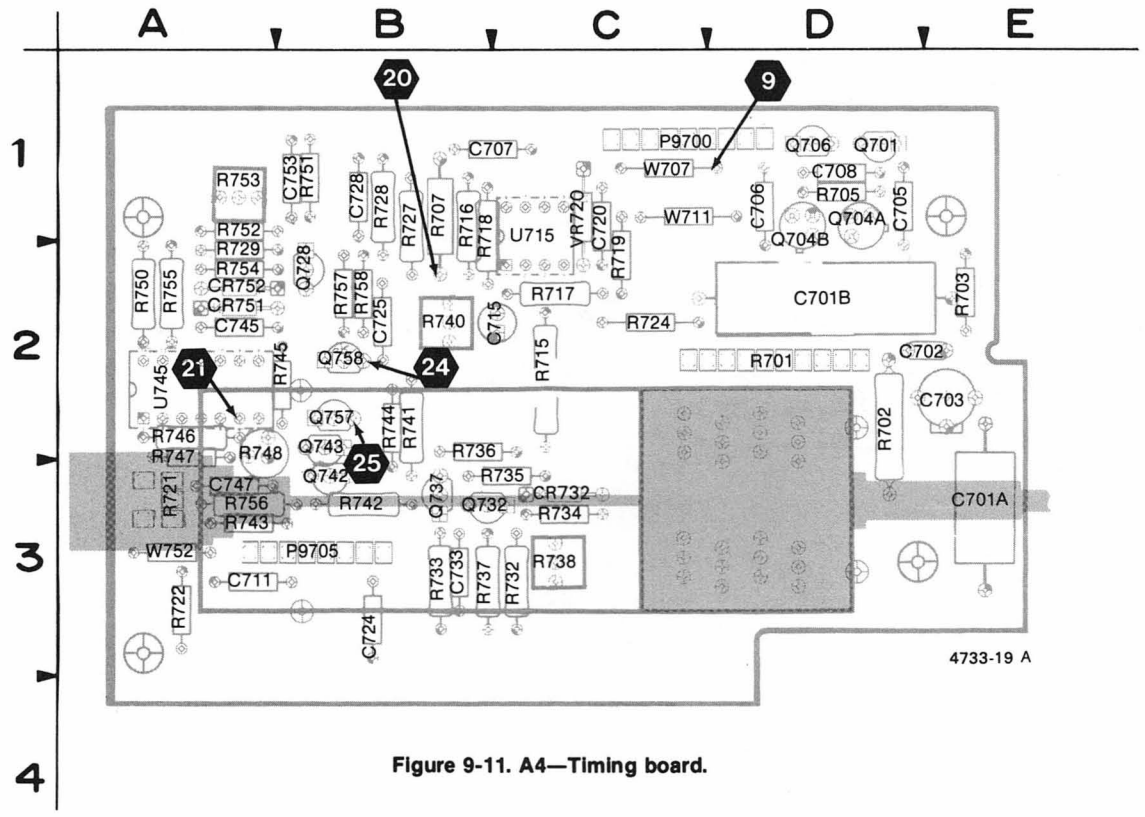
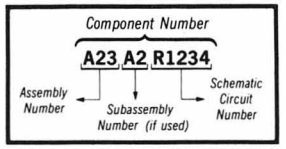


Figure 9-11. A4—Timing board.

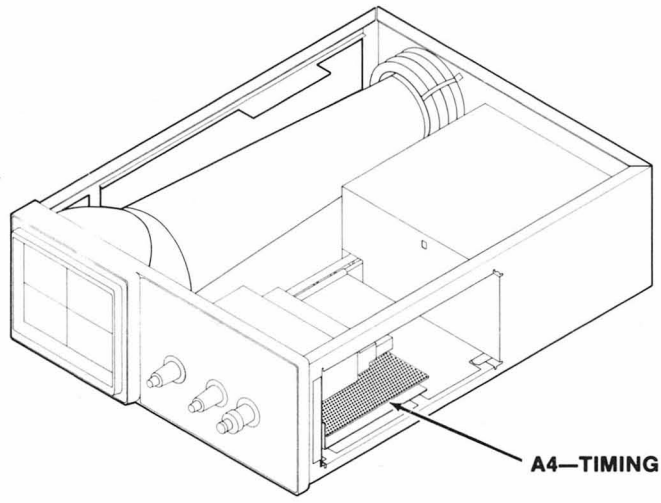
*See Parts serial numb

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 FIG. 9-11

A4—TIMING BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C701	5	P9705-5	5	R735	5
C702	5	P9705-6	5	R736	5
C703	5	P9705-7	5	R737	5
C705	5	P9705-8	5	R738	5
C706	5			R740	5
C707	5	Q701	5	R741	5
C708	5	Q704	5	R742	5
C711	5	Q706	5	R743	5
C715	5	Q728	5	R744	5
C720	5	Q732	5	R745	5
C724	5	Q737	5	R746	5
C725	5	Q742	5	R747	5
C728	5	Q743	5	R748	5
C733	5	Q757	5	R750	5
C745	5	Q758	5	R751	5
C747	5			R752	5
C753	5	R701	5	R753	5
		R702	5	R754	5
CR732	5	R703	5	R755	5
CR751	5	R705	5	R756	5
CR752	5	R707	5	R757	5
		R715	5	R758	5
P9700-1	5	R716	5		
P9700-2	4	R717	5	S721	5
P9700-3	4	R718	5		
P9700-4	4	R719	5	U715	5
P9700-5	4	R721	5	U745	5
P9700-6	4	R722	5		
P9700-7	5	R724	5	VR720	5
P9700-8	5	R727	5		
P9700-9	5	R728	5	W707	5
P9705-1	5	R729	5	W711	5
P9705-2	5	R732	5	W752	5
P9705-3	5	R733	5		
P9705-4	5	R734	5		

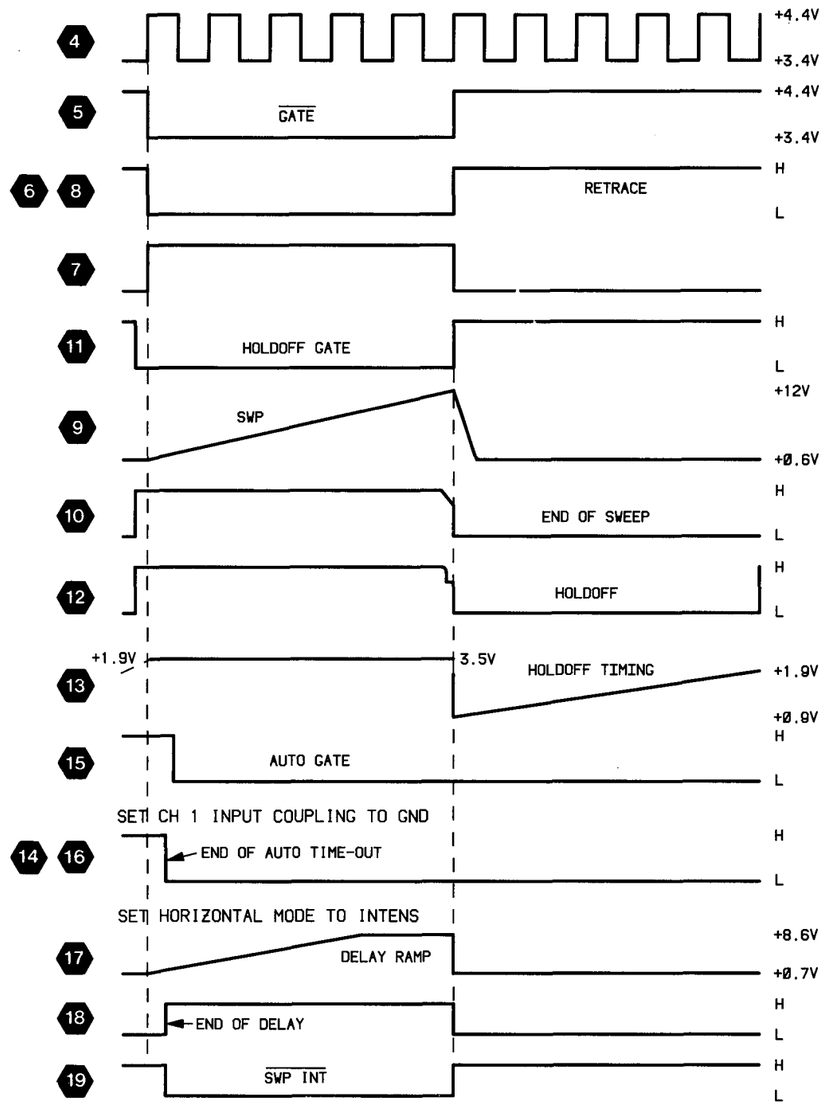
2213A CONTROL SETTINGS

DC Voltages

INTENSITY	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	Ø.1 ms
TRIGGER Mode	P-P AUTO

AC Waveforms

VERTICAL MODE	CH 1
CH 1 VOLTS/DIV	1V
CH 1 Input Coupling	DC
HORIZONTAL MODE	NO DLY
Range Selector	20µs
Multiplier	<X1
TRIGGER LEVEL	Midrange
TRIGGER Mode	P-P AUTO
SOURCE	INT
INT	CH 1
CH 1 Input Signal	1-kHz sine wave, 4V P-P



4733-11

SWEEP LOGIC & DELAY 4

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
C500	8E	8C	P9644-2	5J	8E	R568	9C	7D	U532B	7F	7D
C501	9D	8C	P9644-2	5J	8E	R569	9C	7C	U532C	6G	7D
C502	9M	7C	P9644-3	5J	8E	R571	8G	7D	U532D	9F	7D
C503	9L	6D	P9644-3	5J	8E	R572	6G	8D	U615	5K	7E
C504	7D	6D				R573	8H	8D	U630	2M	7E
C505	7C	6D	Q509	9F	8B	R574	6G	7D			
C506	9L	7D	Q511	8K	7D	R576	6H	7D	VR615	4K	8E
C511	8K	7D	Q525	7F	6D	R577	6J	7D			
C517	5E	6D	Q576	6J	7D	R578	6K	7D	W517	4E	6D
C518	5D	6D	Q578	6K	7D	R580	7J	6D	W519	4C	8E
C519	6D	7E	Q606	4G	7E	R582	7J	7D	W582	6L	7D
C520	5D	7E	Q611	5H	7E	R605	5C	7E	W606	5G	8E
C525	8J	7E				R606	5G	8E	W607	4F	8E
C527	2N	7E	R500	8D	8C	R607	5G	8E	W615	5J	8E
C529	3N	8D	R501	9D	7C	R610	5G	8E	W616	9N	8E
C531	8M	8D	R502	9D	7C	R611	4K	7E	W9001-13	3H	5A
C554	4D	8E	R503	9D	8C	R613	3K	8D	W9001-14	9B	5A
C606	4G	7E	R504	7D	6D	R614	3K	8E	W9001-21	9B	6A
C607	4G	7E	R505	7C	6D	R616	4J	8E	W9001-22	7B	6A
C610	5G	8E	R507	9E	8B	R617	5J	8E	W9001-23	7B	6A
C615	5K	7E	R509	9E	8C	R620	4L	7E	W9001-24	3H	6A
C616	9N	7E	R510	9J	8B	R621	4L	7E	W9001-25	9L	7A
C617	8N	7E	R511	8J	7D	R622	4L	7E	W9001-26	9B	7A
C629	2L	7E	R512	8J	7D	R623	5L	7E	W9001-27	5B	7A
C630	8P	6E	R513	7J	7D	R630	2L	8D	W9001-28	5B	7A
C631	3L	7E	R514	7K	7D	R631	3L	8D	W9001-29	4B	7A
			R516	8J	8D	R632	2N	7E	W9001-30	4B	7A
CR503	6D	6D	R517	8H	8D	R633	2N	7E	W9700-2	4E	4E
CR508	8C	7B	R518	7G	7D				W9700-3	4D	7E
CR509	9F	8B	R523	7C	6E	TP504	5E	7E	W9700-4	4D	7E
CR514	7K	7D	R524	7C	6E				W9700-5	4D	7E
CR518	6E	6D	R525	8J	6E	U502	8E	8C	W9700-6	4D	7E
CR529	3P	8D	R526	6F	7E	U504A	7D	6D	W9700-7	8P	7E
CR617	5J	8E	R527	7N	7E	U504B	6D	6D	W9700-8	8P	7E
			R528	6F	8D	U506A	6H	7D	W9700-9	2P	7E
P9644-1	5J	8E	R529	3P	8D	U506B	7H	7D			
P9644-1	5J	8E	R536	6E	6E	U532A	8H	7D			

Partial A1 also shown on diagrams 2, 3, 5, 6 and 7.

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
R401	9A	2F	S401C	9A	2F	W9000-14	9B	4C	W9000-27	5B	4E
R519	4A	1G	S601	2G	2E	W9000-21	9B	4D	W9000-28	5B	4E
R520	4A	1F	S603	5A	4E	W9000-22	7B	4D	W9000-29	4B	4E
R521	4A	1G				W9000-23	2H	4D	W9000-30	4B	4F
			W515	9B	2G	W9000-24	3H	4D			
S401A	7A	2F	W520	3F	3F	W9000-25	9L	4E			
S401B	9A	2F	W9000-13	3H	4C	W9000-26	9B	4E			

Partial A3 also shown on diagrams 1, 2, 3, 5, 6 and 7.

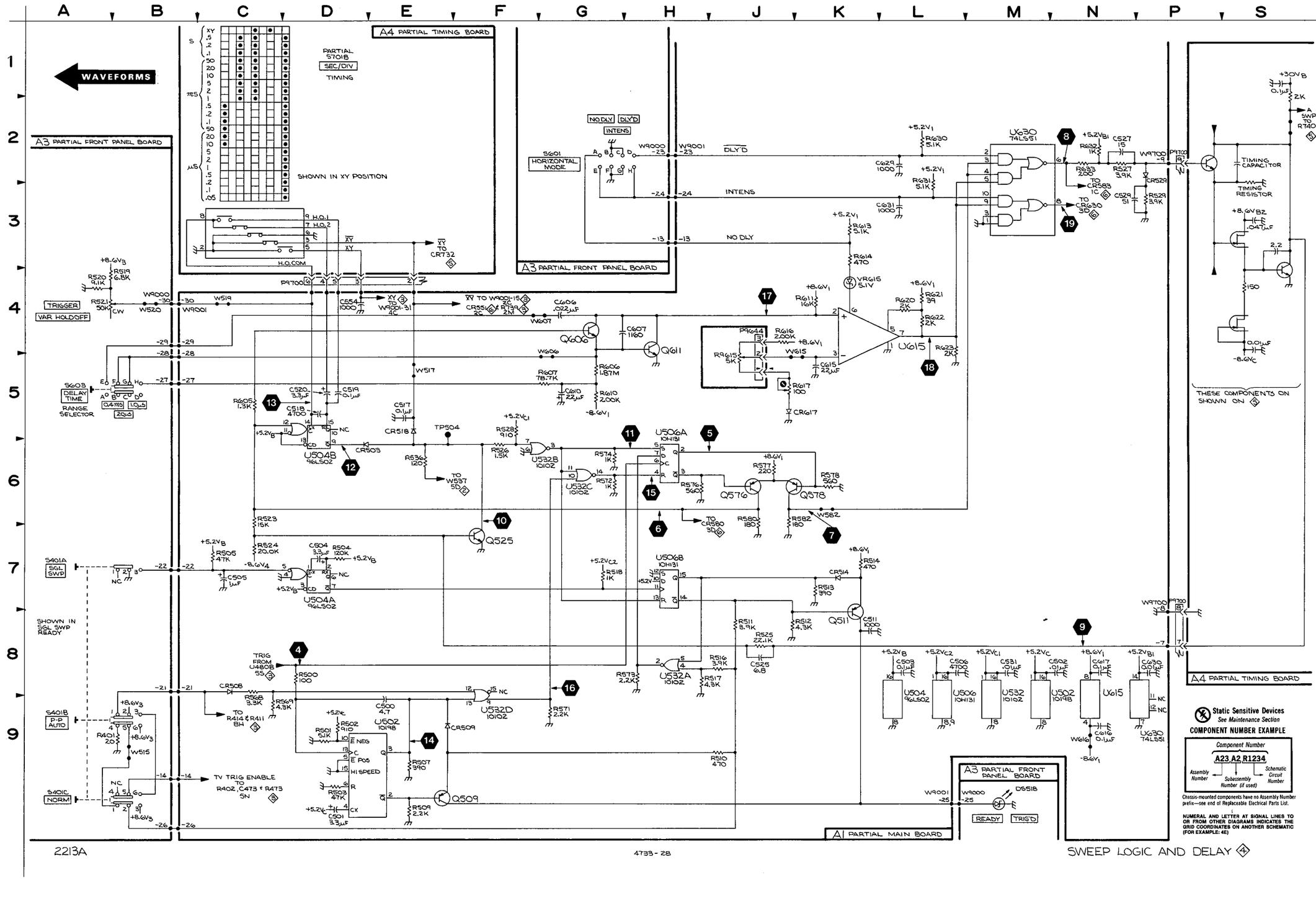
ASSEMBLY A4

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
P9700-2	4E	1C	P9700-4	4D	1C	P9700-6	4D	1D			
P9700-3	4D	1C	P9700-5	4D	1D						

Partial A4 also shown on diagram 5.

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
R9521	3A	CHASSIS									



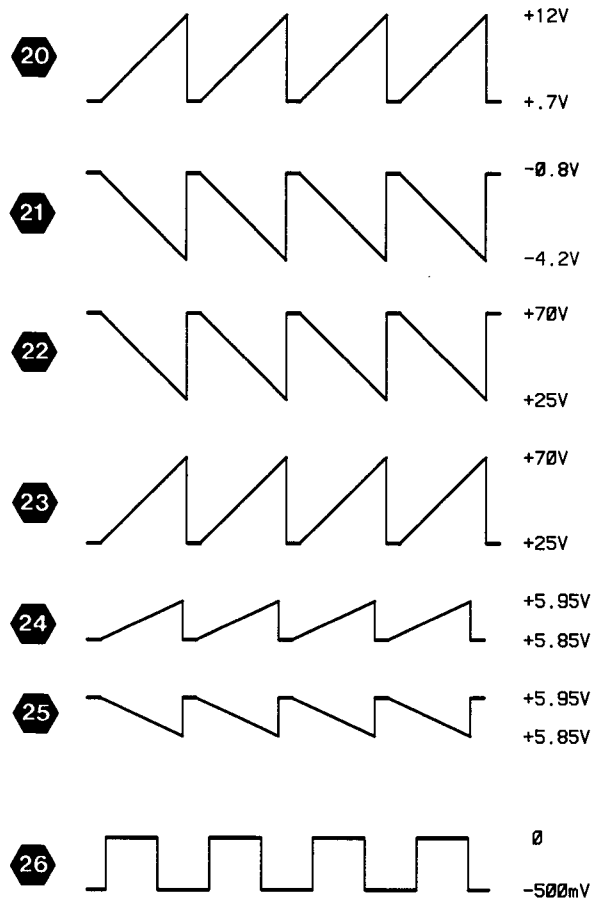
2213A CONTROL SETTINGS

DC Voltages

Input Coupling (both)	GND
HORIZONTAL MODE	NO DLY
TRIGGER Mode	P-P AUTO

AC Waveforms

Input Coupling (both)	GND
HORIZONTAL MODE	NO DLY
X10 Magnifier	Off (knob in)
VAR HOLDOFF	MIN (fully ccw)
TRIGGER Mode	P-P AUTO



4733-12

PROBE ADJUST, XY AMPLIFIER & HORIZONTAL 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
C764	4N	3G	Q770	2N	3F	R778	2S	3E	W726	2E	6D
C775	3P	3F	Q775	3P	3E	R779	2P	3E	W770	2M	4E
C777	2S	3E	Q779	2P	3E	R780	6N	3F	W780	6M	4E
C779	2P	3F	Q780	6N	2F	R781	7N	2F	W9778	3S	3E
C780	4N	3F	Q785	7P	2F	R782	6N	2F	W9788	7S	2E
C782	6P	2F	Q789	6P	2F	R783	6P	2F	W9001-18	2E	6A
C785	7P	2F				R785	7P	2F	W9700-1	2E	7E
C787	6S	2F	R764	4M	3G	R786	6P	2E	W9705-2	6M	5E
C789	6P	2F	R766	2N	3F	R787	5S	2F	W9705-3	2M	5E
			R768	5N	2F	R788	7S	2E	W9705-5	4D	5E
CR764	5M	2G	R770	2N	3F	R789	6P	2E			
CR765	4N	3F	R771	3N	3F	R792	4P	3E			
CR768	4N	3F	R773	3P	3F	R793	5P	3F			
CR770	3M	3G	R775	3P	3F						
CR780	6M	3G	R776	2P	3E	VR764	4M	2G			
			R777	4S	3F	VR782	6P	2F			

Partial A1 also shown on diagrams 2, 3, 4, 6 and 7.

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
C987	2A	2E	R726	2C	1E	R989	1C	2E	W9900	1C	1A
			R985	1A	1E	R990	1C	1B	W9000-18	2C	4D
CR988	1C	2E	R986	1B	1E						
CR989	1A	2C	R987	2B	1E	U985	1B	1D			
			R988	2B	1E						

Partial A3 also shown on diagrams 1, 2, 3, 4, 6 and 7.

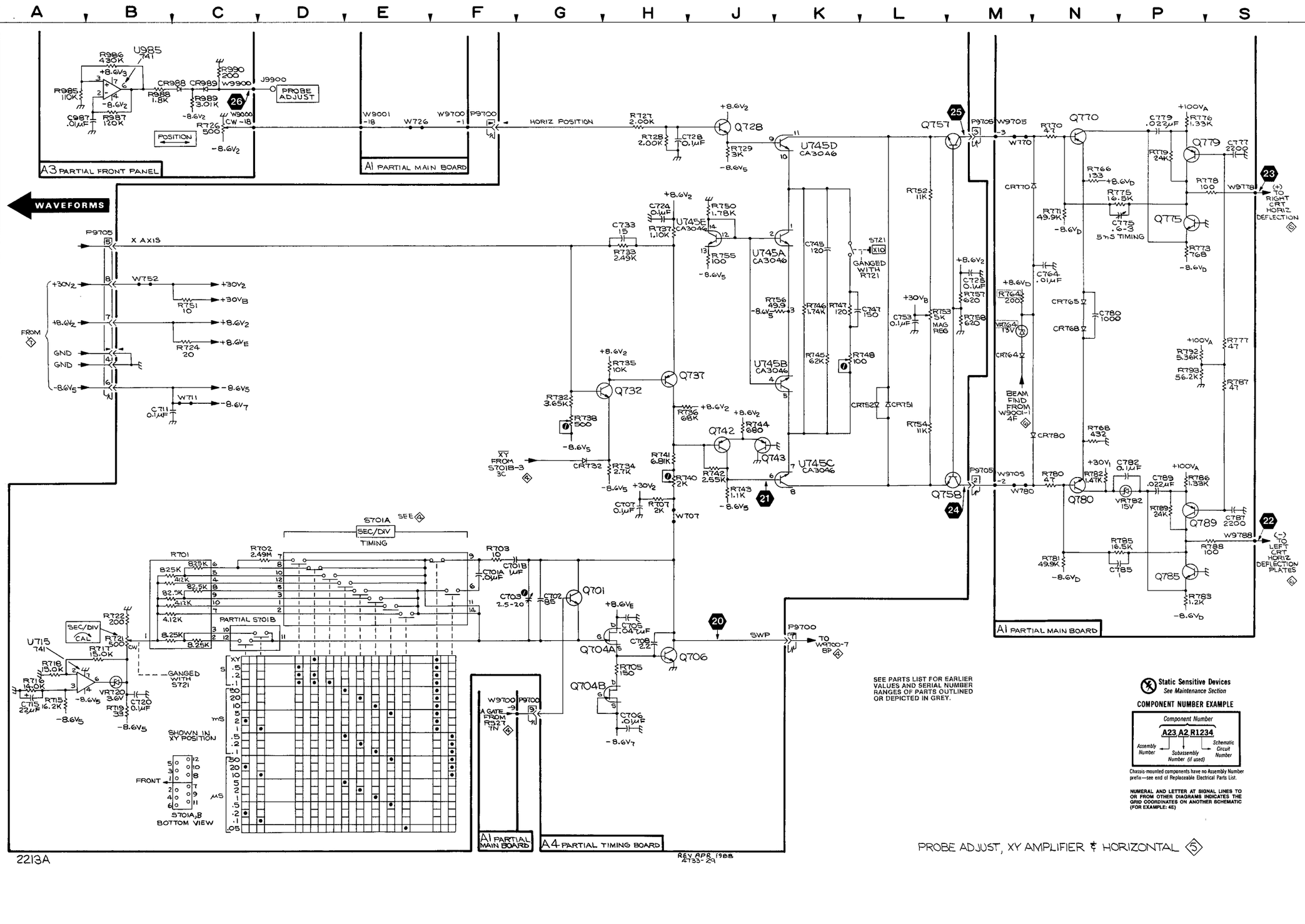
ASSEMBLY A4

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C701A	7F	3E	P9700-9	9G	1D	R707	6H	1B	R747	4K	2A
C701B	7G	3E	P9705-1	5B	3A	R715	9A	2C	R748	5K	2A
C702	7G	2E	P9705-2	6M	3A	R716	8A	1B	R750	3J	2A
C703	7G	2E	P9705-3	2M	3A	R717	8B	2C	R751	4C	1B
C705	8H	1E	P9705-4	5B	3A	R718	8A	1B	R752	3L	1A
C706	9H	1D	P9705-5	3B	3B	R719	9B	1C	R753	4L	1A
C707	6H	1C	P9705-6	5B	3B	R721	8B	3A	R754	5L	1A
C708	8H	1D	P9705-7	4B	3B	R722	8B	3A	R755	3J	2A
C711	5B	3A	P9705-8	4B	3B	R724	4C	2C	R756	4K	3A
C715	9A	1B				R727	2H	1B	R757	4M	2B
C720	9B	1C	Q701	7G	1E	R728	2H	1B	R758	4M	2B
C724									S721	3K	3A
			Q704A	8H	1D	R729	2J	1A			
C725	4M	2B	Q704B	8H	1D	R732	5G	3C	U715	8A	1C
C728	2H	1B	Q706	8H	1D	R733	3H	3B	U745A	3K	2A
C733	3H	3B	Q728	2J	2B	R734	6H	3C	U745B	5K	2A
C745	3K	2A	Q732	5H	3B	R735	5H	3C	U745C	6K	2A
C747	4L	3A	Q737	5H	3B	R736	5H	2B	U745D	2K	2A
C753	4L	1A	Q742	6J	3B	R737	3H	3B	U745E	3J	2A
			Q743	6J	2B	R738	5G	3C	VR720	8B	1C
CR732	6H	3C	Q757	2M	2B	R740	6H	2B			
CR751	5L	2A	Q758	6M	2B	R741	6H	2B	W707	6J	1C
CR752	5L	2A				R742	6J	3B	W711	5C	1C
			R701	7C	2D	R743	6J	3A	W752	4B	3A
P9700-1	2F	1C	R702	7D	2E	R744	5J	2B			
P9700-7	8K	1D	R703	7F	2E	R745	5K	2A			
P9700-8	8K	1D	R705	8H	1D	R746	4K	2A			

Partial A4 also shown on diagram 4.

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
J9900	2E	CHASSIS									



SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

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)

PROBE ADJUST, XY AMPLIFIER & HORIZONTAL 5

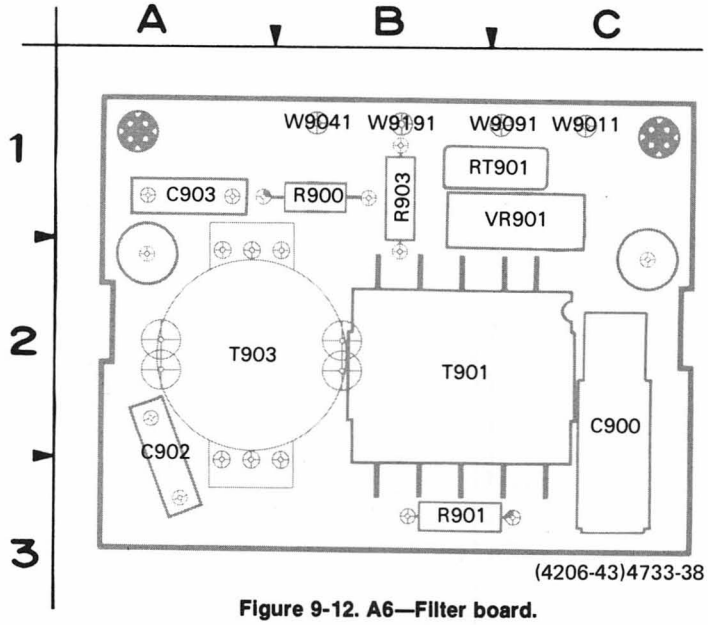


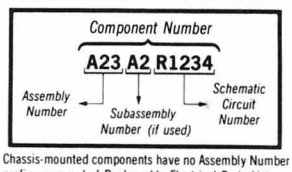
Figure 9-12. A6—Filter board.

A6—FILTER BOARD

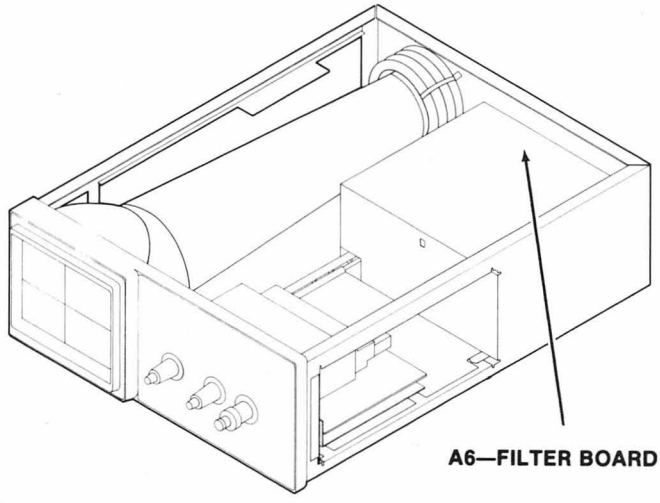
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C900	6	T901	6
C902	6	T903	6
C903	6	VR901	6
R900	6	W9011	6
R901	6	W9041	6
R903	6	W9091	6
RT901	6	W9191	6

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

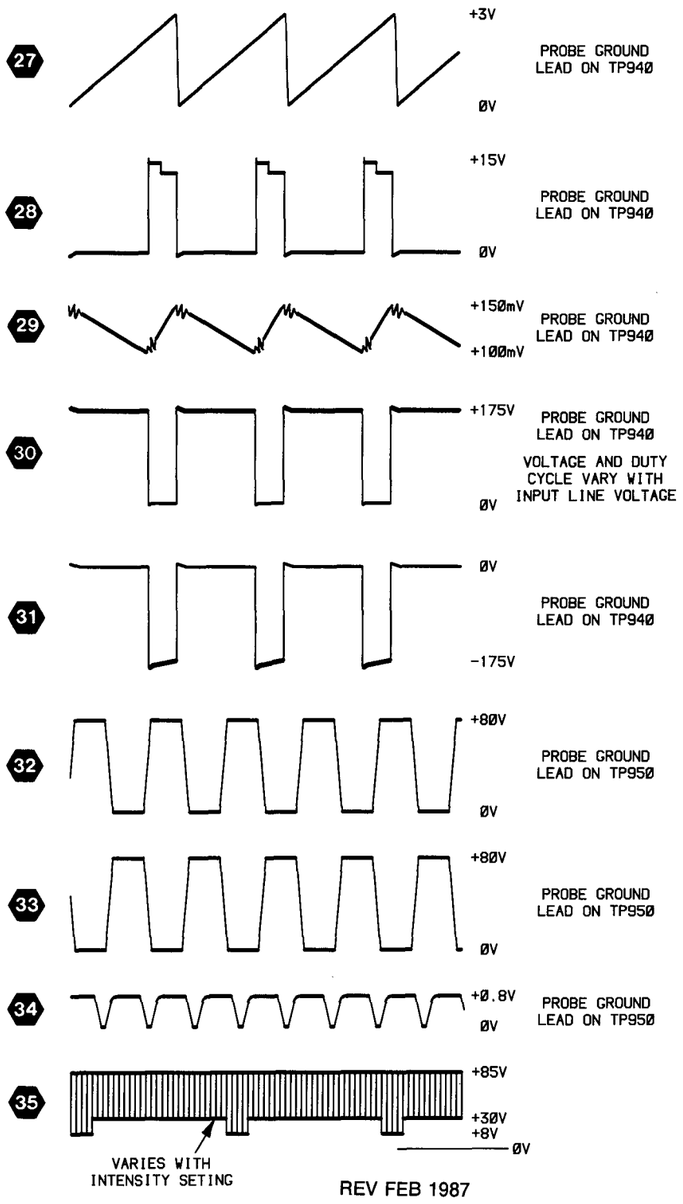
AC Waveforms

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

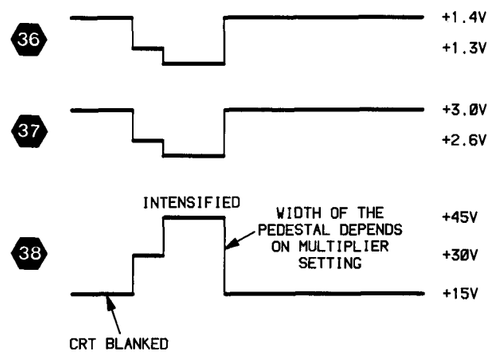
Preregulator and inverter voltages are referenced to test point noted adjacent to the voltage. Power supply output voltages are referenced to chassis ground.



2213A CONTROL SETTINGS

AC Waveforms

VERTICAL MODE	CH 1
CH 1 VOLTS/DIV	5mV
Input Coupling	DC
HORIZONTAL MODE	INTENS
SEC/DIV	50µs
Range Selector	20µs
TRIGGER Mode	P-P AUTO
INT	CH 1
SOURCE	INT
CH 1 Input Signal	1-kHz sine wave, 5 div.



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POWER SUPPLY, Z AXIS & CRT ◇6

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	C944	9F	7H	CR879*	8M	6G	Q835	4H	3J
C824	3E	6E	C945	9F	8J	CR901	5E	5J	Q840	4J	3J
C825	3F	3H	C954	6K	6F	CR902	5E	5J	Q845	3J	3J
C828	4F	3H	C956	7K	6F	CR903	5E	5J	Q885	1L	4G
C832	2G	3H	C960	9L	6F	CR904	5E	5J	Q908	8H	7H
C835	4H	3J	C961	9L	8F	CR907	7J	6H	Q928	6F	7J
C845	3H	3J	C962	9L	7F	CR908	8H	7J	Q930	6G	7J
C847	3J	3J	C963	9L	8F	CR920	6J	7J	Q935	9B	8J
C849	3J	3J	C968	9L	8G				Q938	9D	8J
C851	7M	6H	C970	9L	8G	CR946	9J	8H	Q939	9E	8J
C853	7M	6G	C975	5L	5G	CR947	9J	8H	Q944	9F	8J
C854	6M	5G	C976	5L	5G	CR954	6K	6F	Q946	9H	8H
C855	3M	5G	C979	5M	5G	CR955	7K	6F	Q947	9H	7H
C871	4S	1H				CR956	7K	6F			
C873	5S	1H	CR551	2C	6D	CR957	7K	6F	R397	6D	5E
C875	6S	1H	CR580	3D	7E	CR960	8K	7F	R398	6D	5E
C877	7S	1H	CR583	1C	6D	CR961	9K	8F	R804	3B	4B
C879*	8N	5H	CR630	3D	6E	CR962	9K	7F	R805	2B	5B
C893	7N	4G	CR818	1D	6E	CR963	9K	8F	R818	1D	6E
C904	5D	4J	CR820	2D	6E	CR967	9K	8G	R820	2D	6E
C906	5F	5H	CR821	3D	6E	CR970	9K	8G	R821	3D	6E
C907	7J	6J	CR823	3E	3J				R822	4E	2J
C908	6H	5J	CR824	2F	2J	DS856	5M	5G	R823	3E	2J
C917	8D	7H	CR825	3G	3J	DS858	5M	5G	R825	3E	3J
C919	8F	8J	CR829	3F	3J	DS870	8L	5G	R826	3E	2J
C922	7F	7J	CR840	4H	3J				R828	4F	2G
C925	6E	8J	CR845	3H	3J	E907	8H	6H	R830	3G	2J
C940	9G	6H	CR851	7M	6G				R832	3G	3J
C941	9G	6H	CR853	6M	6H	Q804	3B	5B	R834	4H	3J
C942	9D	8H	CR854	5M	5G	Q825	3F	3J	R835	4G	3J
C943	9C	8H	CR855	5M	5G	Q829	3G	3J	R836	4G	3J

TABLE (cont)

POWER SUPPLY, Z AXIS & CRT 6 (cont)

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
R840	4H	3J	R893	6N	4F	R939	9C	8H	U975	4K	5F
R841	3G	3J	R894	6M	5F	R940	9C	8H			
R842	3J	3J	R905	6D	4J	R941	9E	8J	VR828	4F	3H
R844	3H	3J	R906	6D	5J	R942	9D	8J	VR925	7F	7J
R845	3H	3J	R907	9J	6H	R943	9E	8J	VR935	9C	8J
R849	3J	3J	R908	8H	7J	R944	9F	8J	VR943	9E	8J
R851	7M	4J	R909	8H	7H	R945	9F	8H	W934*	9C	8J
R852	7M	4J	R910	7B	5A	R946	9H	8H	W9040	5D	5J
R853	7M	6G	R912	9C	7J	R947	9H	7H	W9190	5D	5H
R854	6M	5G	R913	8C	7J	R949	9H	8H	W9800	4B	3J
R855*	7M	6G	R914	8D	7H	R971	9L	8G	W9001-1	4F	4A
R858	6M	5G	R915	8D	7J	R976	4L	5G	W9001-4	3B	5A
R860	4M	5G	R916	8F	7J	R978	4L	5G	W9070-1	8H	6H
R870	4S	1H	R917	8D	7H				W9070-2	7H	6H
R871	4S	1H	R919	8F	8J	S901	5D	4J	W9070-3	8H	7H
R872	5S	1H	R921	8E	7J				W9150-1	7B	5A
R873	4S	1G	R922	8F	7J	T390	6D	4H	W9150-2	8B	5A
R874	6S	1G	R925	6F	7J	T906	6J	6J	W9870-10	4S	1H
R875	6S	1G	R926	5E	7J	T944	9H	7H	W9870-12	3N	4G
R877	7S	1H	R927	7F	7J	T948	4J	6G	W9870-14	8N	4G
R879*	8N	6F	R928	6F	7J				W9870-1	8N	4G
R885	1K	4H	R929	6F	7J	TP842	3J	3J	W9870-2	8N	4G
R886	2L	4G	R930	6F	7J	TP900	9L	8E	W9870-3	7N	4G
R888	1L	4G	R934*	9C	8J	TP940	9C	8J	W9870-4	7N	4G
R889	1M	4G	R935	9C	8J	TP950	9C	7H	W9870-5	6S	1H
R890	1M	4G	R937	9C	8H				W9870-7	5S	1H
R891	1M	4G	R938	9C	8J	U930	9G	7J	W9870-8	7S	1H
R892	6N	4F									

Partial A1 also shown on diagrams 2, 3, 4, 5 and 7.

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
P9006-1	3S	2A	R800	3A	2A	S390	5F	2A	W9000-4	3A	4A
P9006-2	3S	2A	R982	3S	2A						
			R983	3S	2A	W9000-1	5E	4A			

Partial A3 also shown on diagrams 1, 2, 3, 4, 5 and 7.

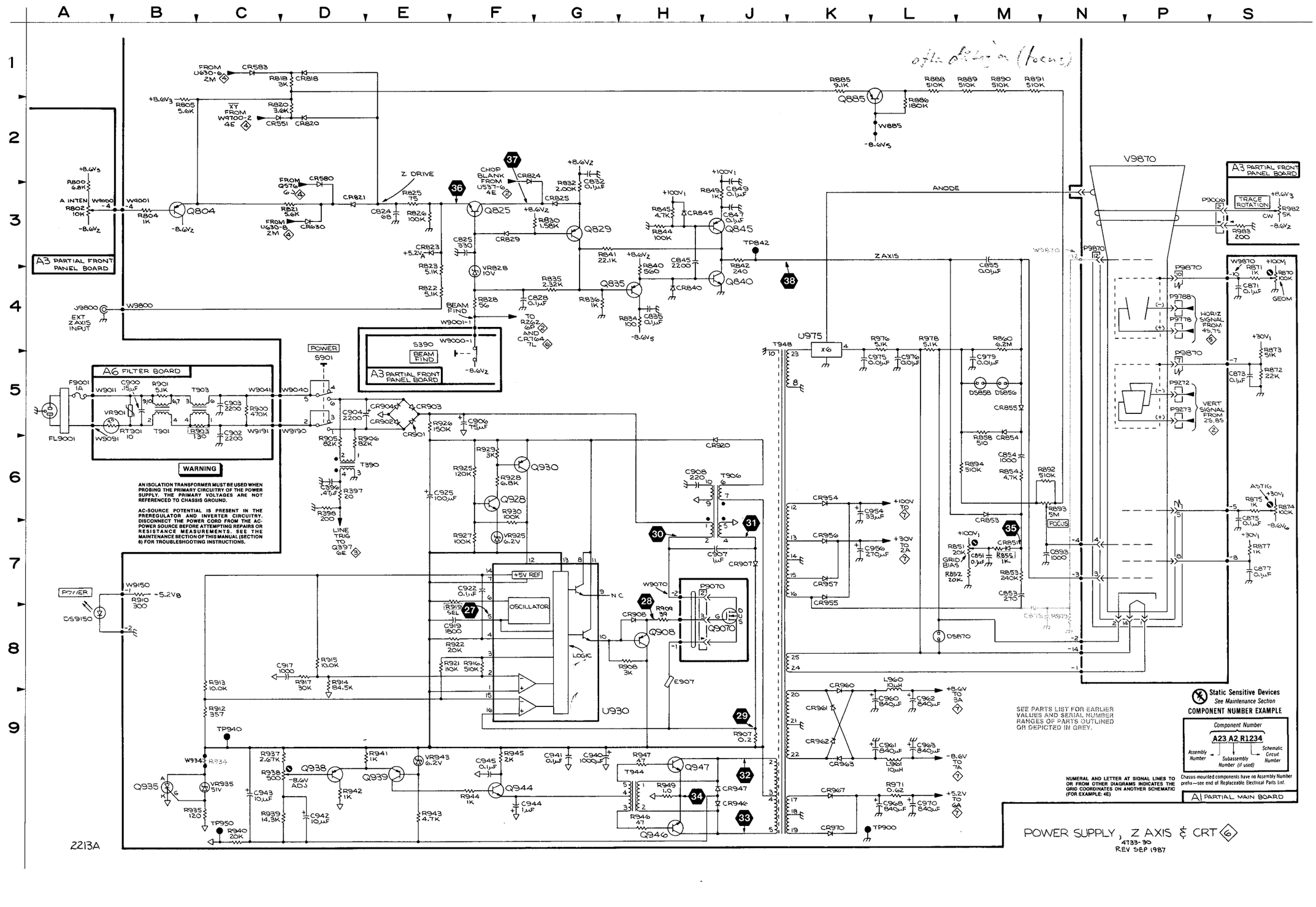
ASSEMBLY A6

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
			RT901	5B	1B	VR901	5B	1C	W9191	5C	1B
R900	5C	1B									

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
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			

***See Parts List for serial number ranges.**



POWER SUPPLY, Z AXIS & CRT

6

POWER SUPPLY, Z AXIS & CRT 6

4733-30
REV SEP 1987

POWER DISTRIBUTION 7

ASSEMBLY A1

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C200	4H	3E	R797	4K	3G	W972	3C	6E
C201	8H	3E	R799	2C	3E	W974	4J	3H
C220	4G	2D	R964	6B	3H	W975	4K	3H
C274	3C	2G	R966	6E	7E	W976	7C	7E
C451	8F	6D				W977	7D	6E
C494	4E	5D	TP961	7B	8E	W979	8K	3H
C499	8E	5C				W991	4C	5B
C507	6E	6C	W494	4E	5D	W993	9C	5B
C590	6H	7D	W556	6C	2H	W995	9C	6B
C796	8L	2G	W590	7H	7C	W997	4G	4D
C797	4K	3G	W591	6H	7D	W998	8G	4E
C799	2D	3F	W592	6G	8C	W999	8H	2E
			W631	6E	7E	W9001-11	5P	5A
E200	4G	4E	W954	1C	6F	W9001-5	4P	5A
E201	8H	4E	W955	1C	4H	W9705-1	3N	5E
E272	3D	1G	W956	2C	5F	W9705-4	3N	5E
E590	6G	8C	W959	1C	4E	W9705-6	3N	5E
			W960	3B	7F	W9705-7	3N	5E
R220	4H	2D	W961	7B	8F	W9705-8	2N	5E
R451	8E	6D	W964	2C	3H	W9991-1	8N	5E
R494	4D	5E	W965	2C	3H	W9991-2	9N	5E
R499	8E	5E	W968	6D	8F	W9991-3	9N	5E
R796	8K	2G	W971	3C	7E			

Partial A1 also shown on diagrams 2, 3, 4, 5 and 6.

ASSEMBLY A3

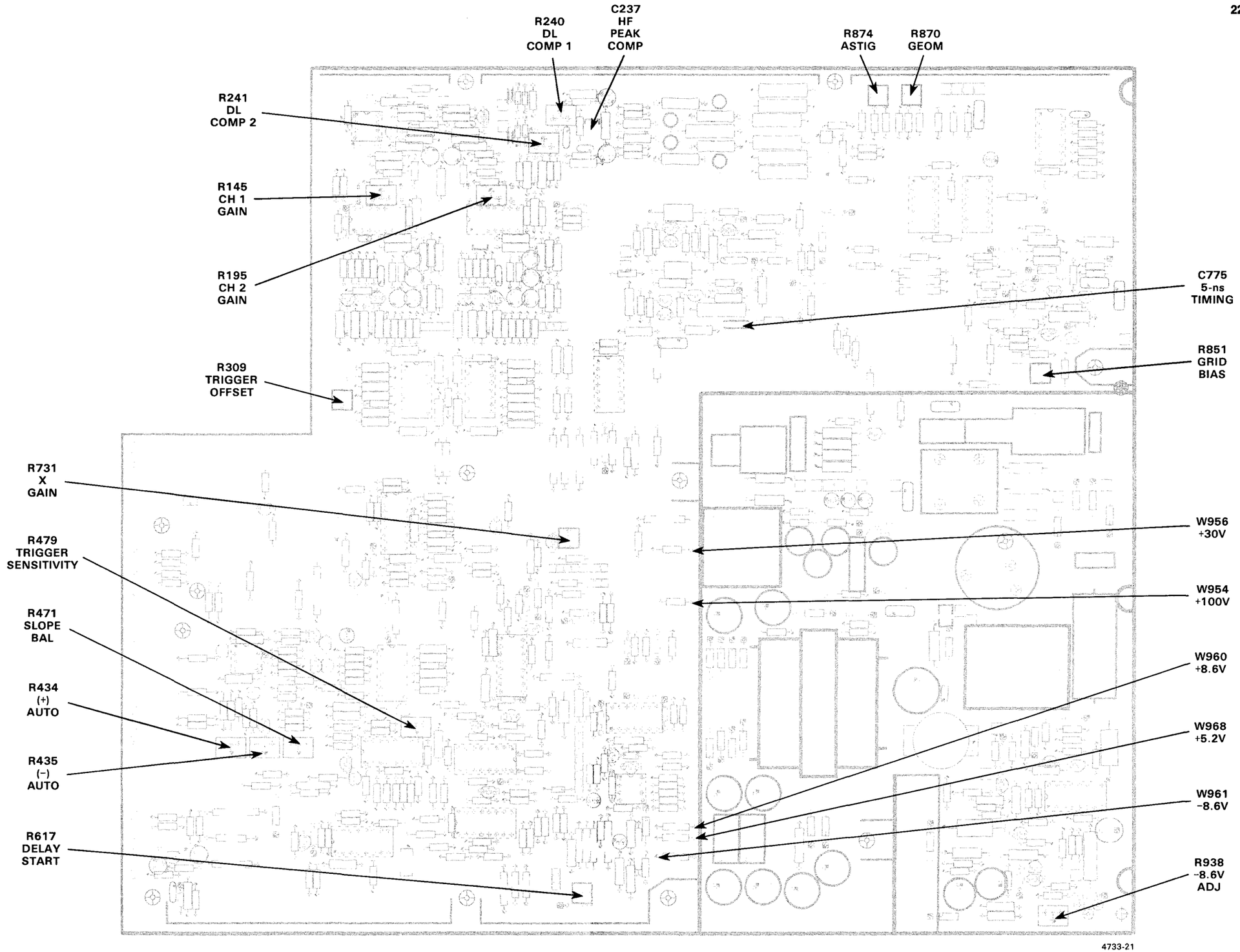
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
W89	4P	1C	W9000-11	5P	4B	W9000-5	5P	4A

Partial A3 also shown on diagrams 1, 2, 3, 4, 5 and 6.

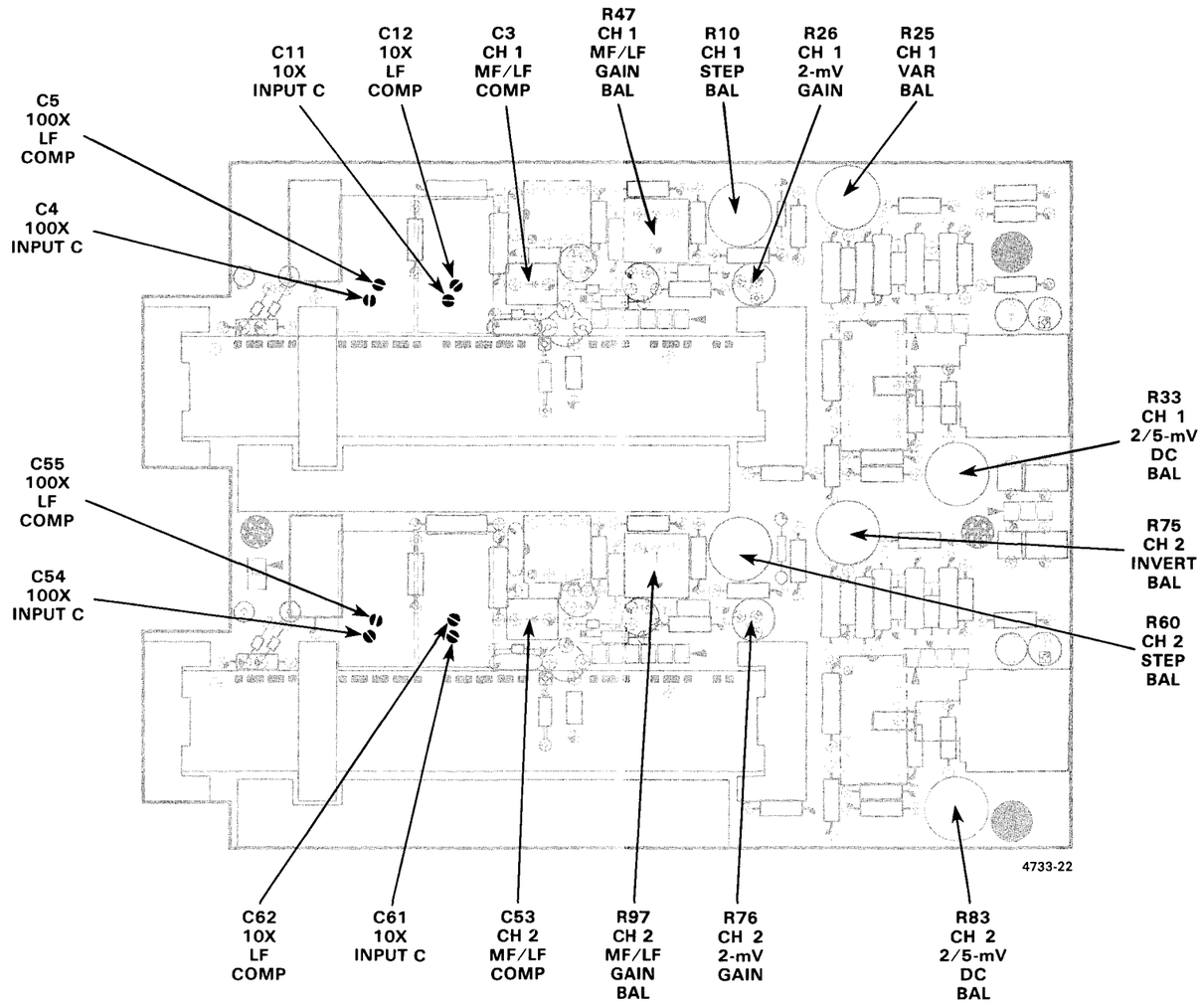
2213A

4733-31

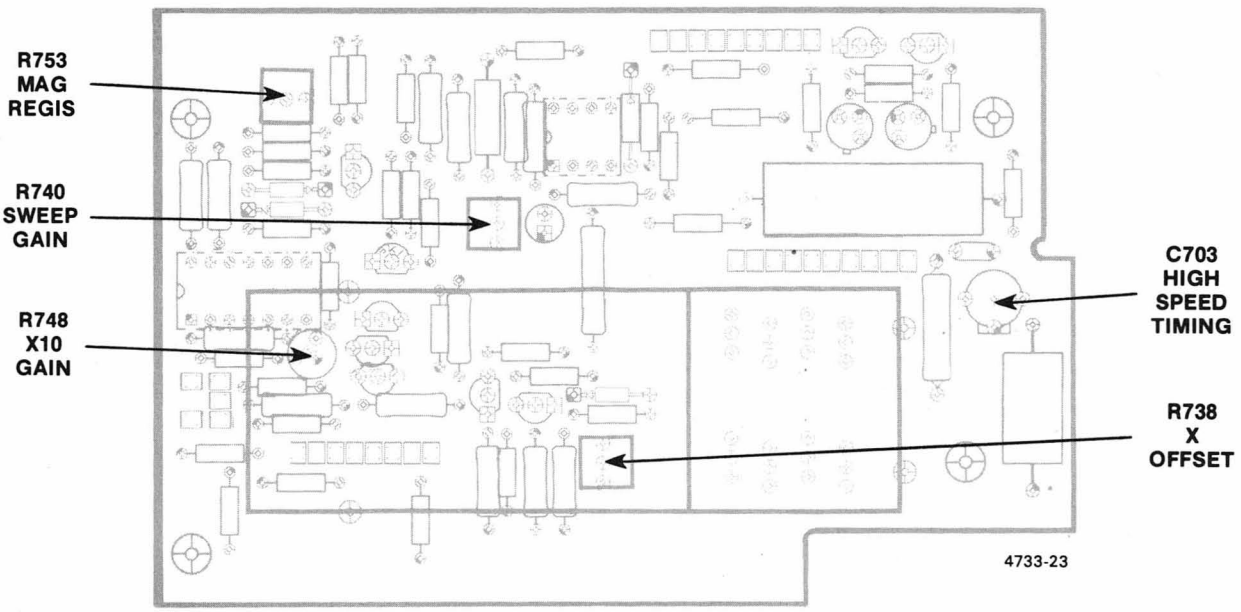
POWER DISTRIBUTION 7



A1—MAIN BOARD ADJUSTMENT LOCATIONS



A2—ATTENUATOR BOARD ADJUSTMENT LOCATIONS



A4—TIMING 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)
INTENSITY	Midrange
FOCUS	Midrange
Vertical POSITION	Midrange
VERTICAL MODE	CH 1
CH 1 VOLTS/DIV	Ø.1V
CH 1 VOLTS/DIV Variable	Cal detent
CH 1 Input Coupling	GND
Horizontal POSITION	Midrange
HORIZONTAL MODE	NO DLY
SEC/DIV	Ø.1ms
SEC/DIV Variable	Cal detent
X1Ø Magnifier	Off (knob in)
TRIGGER Mode	P-P AUTO
INT	VERT MODE
SOURCE	INT

2. Verify the low-voltage power supplies at the following test points:

SUPPLY	TEST POINT	TOLERANCE
+5.2V	W968	5.Ø4 to 5.36V
+8.6V	W96Ø	8.43 to 8.77V
-8.6V	TP961	-8.56 to -8.64V
+3ØV	W956	29.1 to 3Ø.9V
+1ØØV	W954	97 to 1Ø3V

NOTE

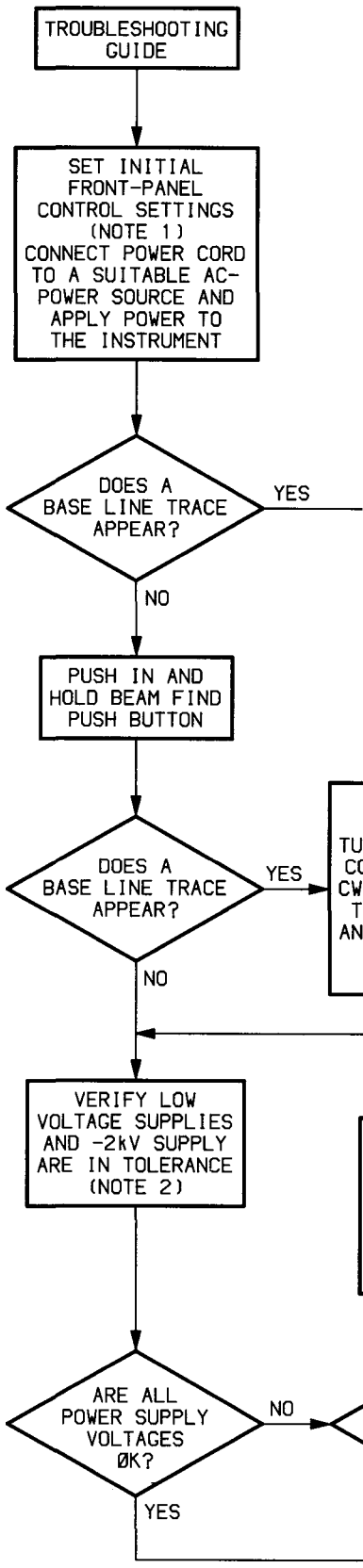
A HV probe is required to measure the -2kV supply. Turn off the power and make the test equipment connections to the oscilloscope. Set the voltmeter to read at least -3kV, then turn the oscilloscope power back on to take the reading. After obtaining the reading, turn off the oscilloscope power to disconnect 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 -19ØØ and -21ØØV.

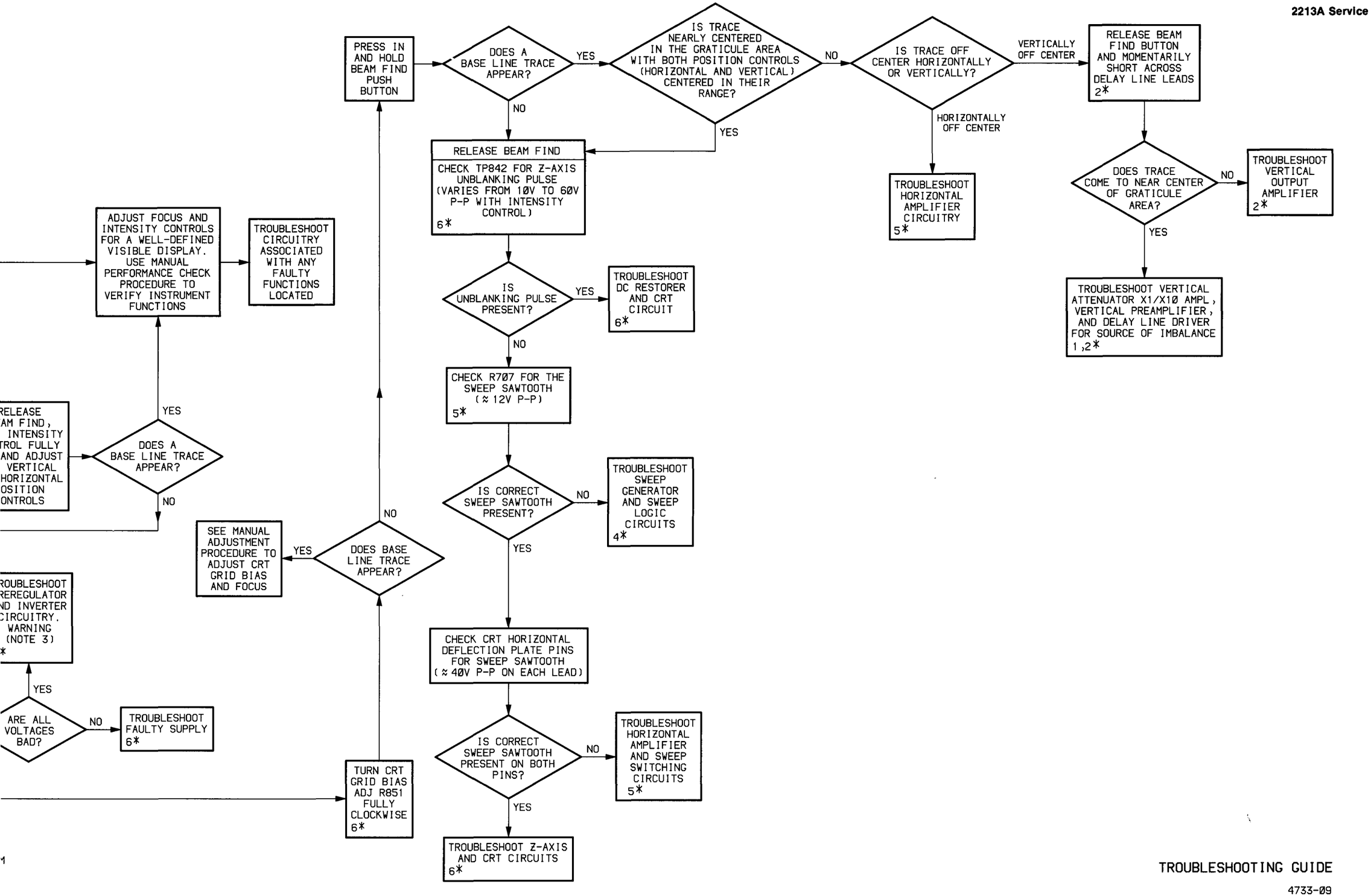
3.

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 INDICATI
SCHEMATIC DIAG



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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
02768	ILLINOIS TOOL WORKS INC FASTEX DIVISION	195 ALGONQUIN ROAD	DES PLAINES IL 60016-6103
06383	PANDUIT CORP	17301 RIDGELAND	TINLEY PARK IL 07094-2917
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646-6013
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
09922	BURNDY CORP	RICHARDS AVE	NORWALK CT 06852
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
16428	COOPER BELDEN ELECTRONIC WIRE AND CA SUB OF COOPER INDUSTRIES INC	NW N ST	RICHMOND IN 47374
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT CONNECTOR SYSTEMS DIV MILITARY PRODUCTS GROUP	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
22670	G M NAMEPLATE INC	2040 15TH AVE WEST	SEATTLE WA 98119-2728
23740	AMUNEAL MFG CORP	4737 DARRAH	PHILADELPHIA PA 19124-2705
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53 RT 80 BOX A	DELAWARE WATER GAP PA 18327
70903	COOPER BELDEN ELECTRONICS WIRE AND C SUB OF COOPER INDUSTRIES INC	2000 S BATAVIA AVE	GENEVA IL 60134-3325
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
86113	MICRODOT MFG INC CENTRAL SCREW-KEENE DIV	149 EMERALD ST	KEENE NH 03431-3628
86928	SEASTROM MFG CO INC	701 SONORA AVE	GLENDALE CA 91201-2431
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181
98291	SEALECTRO CORP BICC ELECTRONICS	40 LINDEMAN DR	TURNBULL CT 06611-4739
S3109	FELLER	ASA ADOLF AG STOTZWEID CH8810	HORGEN SWITZERLAND
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
TK0174	BADGLEY MFG CO	1620 NE ARGYLE	PORTLAND OR 97211
TK0858	STAUFFER SUPPLY CO (DIST)	810 SE SHERMAN	PORTLAND OR 97214
TK0861	H SCHURTER AG DIST PANEL COMPONENTS	2015 SECOND STREET	BERKELEY CA 94170
TK1154	COMPLEX TOOLING INC	4635 NAUTILUS COURT SOUTH	BOULDER CO 80301
TK1326	NORTHWEST FOURSLIDE INC	18224 SW 100TH CT	TUALATIN OR 97062
TK1336	PARSONS MFG CORP	1055 OBRIEN	MENLO PARK CA 94025
TK1373	PATELEC-CEM (ITALY)	10156 TORINO	VAICENTALLO 62/45S ITALY
TK1543	CAMCAR/TEXTRON	600 18TH AVE	ROCKFORD IL 61108-5181
TK1570	HERD MFG	9227 CLINTON RD	CLEVELAND OH 44144
TK1694	ROSE CITY LABEL CO	7235 SE LABEL LN	PORTLAND OR 97213
TK2165	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
TK2278	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	334-5001-06			1	MARKER,IDENT:MKD CAUTION	80009	334-5001-06
	334-5001-09			1	MARKER,IDENT:MKD CAUTION 10K OHM UK	80009	334-5001-09
	334-5258-00	B027409		1	MARKER,IDENT:MKD X-RAY WARNING,GERMAN (OPTION A1 & A5 ONLY)	TK1694	ORDER BY DESCR
-2	200-2538-01	B010100	B017062	1	COVER,REAR:PLASTIC,W/MARKERS	80009	200-2538-01
	200-2538-06	B017063	B027912	1	COVER,REAR:PLASTIC,W/LABELS	80009	200-2538-06
	200-2538-13	B027913		1	COVER,REAR:PLASTIC,W/LABELS	80009	200-2538-13
	343-1278-00	B023200		2	RTNR,POWER CORD:POLYCARBONATE GRAY (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-3	211-0691-00	B010100	B023199	2	SCREW,MACHINE:6-32 X 0.625,PNH,STL	TK0858	ORDER BY DESCR
	211-0712-00	B023200		2	SCR,ASSEM WSHR:6-32 X 1.25,PNH,STL,TORX (END ATTACHING PARTS)	01536	ORDER BY DESCR
-4	213-0882-00			1	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	83385	ORDER BY DESCR
-5	334-0075-00			1	MARKER,IDENT:MKD HANDLE,2213A	80009	334-0075-00
-6	367-0289-00			1	HANDLE,CARRYING:13.855,SST (ATTACHING PARTS)	80009	367-0289-00
-7	212-0144-00			2	SCREW,TPG,TF:8-16 X 0.562 L,PLASTITE (END ATTACHING PARTS)	93907	225-38131-012
-8	211-0304-00			1	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,T9 TORX	01536	ORDER BY DESCR
-9	390-0790-06			1	CABINET,SCOPE:W/FEET	80009	390-0790-06
-10	348-0659-01	B010100	B022289	2	FOOT,CABINET:BLACK POLYURETHANE	80009	348-0659-01
	348-0659-00	B022290		2	FOOT,CABINET:BLACK POLYURETHANE	80009	348-0659-00

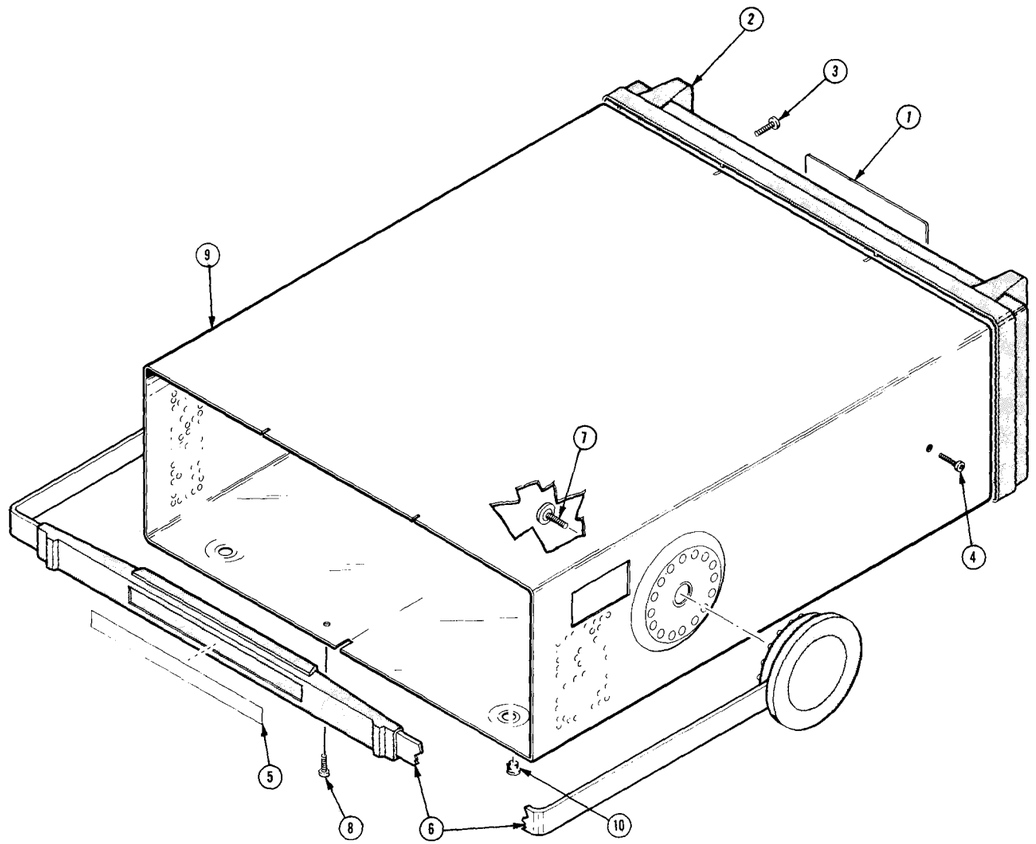


FIG. 1 CABINET

FIG. 2 LEFT & RIGHT SIDES

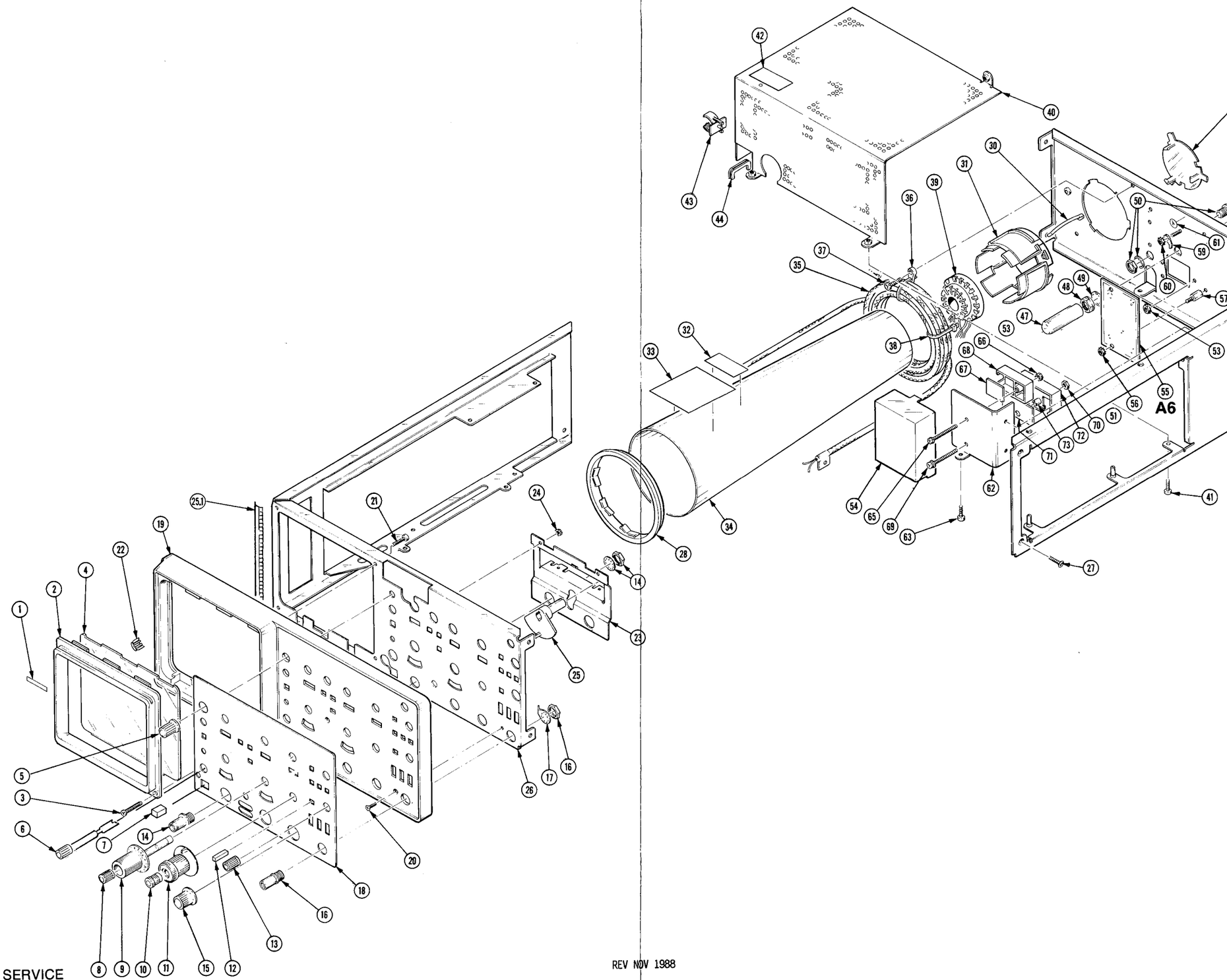


Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	334-5002-00			1	PLATE,IDENT:MKD TEKTRONIX	80009	334-5002-00
-2	426-1765-00	B010100	B016189	1	FRAME,CRT:POLYCARBONATE,GRAY	80009	426-1765-00
	426-1765-02	B016190		1	FRAME,CRT:POLYCARBONATE,GRAY	TK2165	ORDER BY DESCR
					(ATTACHING PARTS)		
-3	211-0690-01			2	SCREW,MACHINE:6-32 X 0.875 PNH,SST	86113	ORDER BY DESCR
					(END ATTACHING PARTS)		
-4	337-2775-00			1	SHLD,IMPLOSION:FILTER,BLUE	80009	337-2775-00
-5	366-1708-03			1	KNOB:SIL GY,0.127 ID X 0.5 OD X 0.531 H	80009	366-1708-03
-6	384-1575-00			1	EXTENSION SHAFT:8.805 L,W/KNOB,PLASTIC	80009	384-1575-00
-7	366-1480-03			1	PUSH BUTTON:BLACK,OFF	80009	366-1480-03
-8	366-1031-03			2	KNOB:RED,CAL,0.127 ID X 0.392 OD X 0.466 H	80009	366-1031-03
-9	366-2148-01			2	KNOB:GY,V/DIV,0.72 OD,0.79 H	80009	366-2148-01
-10	366-2054-01			1	KNOB:RED,CAL,0.08 ID X 0.45 OD X 0.456	80009	366-2054-01
-11	366-1852-01			1	KNOB:GY,SEC/DIV,0.25 ID X 0.79 H	80009	366-1852-01
-12	366-2013-00			7	PUSH BUTTON:DIRTY GRAY,0.134 SQ X 0.480 H	80009	366-2013-00
-13	366-2049-01			5	KNOB:GY,0.172 ID X 0.41 OD X 0.496 H W/BAR	80009	366-2049-01
-14	131-0126-00			2	CONN,RCPT,ELEC:BNC,FEMALE	24931	28JR205-2
-15	366-2020-01			1	KNOB:0.252 ID X 0.581 OD X 0.612H	80009	366-2020-01
-16	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
	220-0495-00	B010100	B027375	1	NUT,PLAIN,HEX:0.375-32 X 0.438 HEX,BRS	73743	ORDER BY DESCR
	210-0590-00	B027376		1	NUT,PLAIN,HEX:0.375-32 X 0.438 BRS CD PL	73743	28269-402
-17	210-0255-00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
-18	333-1861-00			1	PANEL,FRONT:	80009	333-1861-00
-19	386-4850-00	B010100	B018667	1	SUBPANEL,FRONT: POLYCARBONATE,2200 SERIES	80009	386-4850-00
	386-4850-03	B018668		1	SUBPANEL,FRONT:	80009	386-4850-03
					(ATTACHING PARTS)		
-20	213-0881-00			3	SCREW,TPG,TR:6-32 X 0.25 TYPE TT,FILH,STL	83385	ORDER BY DESCR
-21	213-0882-00			2	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-22	348-0660-00			4	CUSHION,CRT:POLYURETHANE	80009	348-0660-00
-23	407-2824-00	B010100	B012313	1	BRACKET,GROUND:PANEL,STEEL	80009	407-2824-00
	407-3217-00	B012314		1	BRACKET,GROUND:ALUMINUM	TK1570	ORDER BY DESCR
					(ATTACHING PARTS)		
-24	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-25	214-3375-00			2	LEVER,SWITCH:AC-GND-DC,PLASTIC	80009	214-3375-00
-25.1	348-0274-00			1	SHLD GSKT,ELEK:FINGER TYPE,24.0 L	30817	97-555CDC
-26	441-1631-00	B010100	B015389	1	CHASSIS,SCOPE:FRONT	80009	441-1631-00
	441-1571-00	B015390		1	CHASSIS,SCOPE:FRONT,L FRAME	TK2278	ORDER BY DESCR
					(ATTACHING PARTS)		
-27	213-0881-00			4	SCREW,TPG,TR:6-32 X 0.25 TYPE TT,FILH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
	344-0367-00	B016641	B020966	2	CLIP,GROUND:CU-BE	80009	344-0367-00
	344-0367-00	B020967	B027672	3	CLIP,GROUND:CU-BE	80009	344-0367-00
-28	386-4443-00			1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386-4443-00
-29	200-2519-00			1	CAP,CRT SOCKET:NATURAL LEXAN	80009	200-2519-00
-30	214-1061-05	B010100	B027174	1	SPRING,GROUND:PLATED	TK1326	ORDER BY DESCR
	214-1061-06	B027175		1	SPRING,GROUND:CRT SHIELD	80009	214-1061-06
-31	426-1766-00			1	MOUNT,RESILIENT:CRT,REAR	80009	426-1766-00
-32	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	07416	ORDER BY DESCR
-33	334-1951-00			1	MARKER,IDENT:MKD WARNING,CRT VOLTAGES	22670	ORDER BY DESCR
-34	337-2774-00			1	SHIELD,ELEC:CRT,STEEL	23740	C-2059
-35	----- -----			1	DELAY LINE,ELEC:(SEE DL9210 CHASSIS REPL)		
	210-0802-00	B010100	B024549	1	WASHER,FLAT:0.15 ID X 0.312 OD X 0.032,STL	12327	ORDER BY DESCR
-36	346-0121-00			2	STRAP,TIEDOWN,E:6.125 L,NYLON	06383	PLC1.5I-S8
					(ATTACHING PARTS)		
-37	213-0882-00			2	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	83385	ORDER BY DESCR
					(END ATTACHING PARTS)		
-38	346-0128-00			1	STRAP,TIEDOWN,E:8.0 L X 0.1 W,NYLON	06383	PLT2M
-39	136-0202-08	B010100	B015234	1	SKT,PL-IN ELEK:ELECTRON TUBE,14 CONTACT	80009	136-0202-08
	136-0830-00	B015235		1	SKT,PL-IN ELEK:CRT SOCKET ASSY	80009	136-0830-00
-40	337-2772-02			1	SHIELD,ELEC:POWER SUPPLY ASSY,AL	80009	337-2772-02
					(ATTACHING PARTS)		
-41	211-0305-00			4	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,CD PL	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
					POWER SUPPLY ASSEMBLY INCLUDES:		
-42	334-4251-00			1	MARKER,IDENT:MKD CAUTION	07416	ORDER BY DESCR
-43	344-0347-00			1	CLIP,ELECTRICAL:ANODE,0.72 OD,NYLON	TK2165	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-44	348-0555-00			1	GROMMET,PLASTIC:SIL GY,U SHAPE,0.52 ID	80009	348-0555-00
-45	134-0158-00			2	BUTTON,PLUG:0.187 DIA,NYLON	02768	207-080501-00
-46	200-2264-00			1	CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
-47	200-1388-03			1	COVER,FUSE LEAD:POLYURETHANE	80009	200-1388-03
-48	204-0833-00			1	BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	TK0861	031 1653 (FEU)
-49	210-1039-00			1	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST	24931	ORDER BY DESCR
-50	131-0955-00			2	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
-51	----- -----			1	LINE FILTER:(SEE FL9001 CHASSIS REPL)		
					(ATTACHING PARTS)		
-52	211-0323-00	B010100	B021074	2	SCREW,MACHINE:4-40 X 0.312,FLH,100 DEG,STL	83385	ORDER BY DESCR
	211-0380-00	B021075		2	SCREW,MACHINE:4-40 X 0.375,FLH,CD PL,T-9	80009	211-0380-00
-53	210-0586-00	B010100	B028579	2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-54	200-2845-00			1	COVER,CKT BD:LINE FILTER	TK2165	ORDER BY DESCR
-55	----- -----			1	CIRCUIT BOARD ASSY:(SEE A6 REPL)		
					(ATTACHING PARTS)		
-56	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
					(END ATTACHING PARTS)		
-57	129-0999-00			1	SPACER,POST:0.485 L,4-40 INT/EXT,STL	TK2278	ORDER BY DESCR
					(ATTACHING PARTS)		
-58	211-0303-00	B010100	B021074	4	SCREW,MACHINE:4-40 X 0.25,FLH 100 DEG,STL	TK1543	ORDER BY DESCR
	211-0379-00	B021075		4	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9	80009	211-0379-00
					(END ATTACHING PARTS)		
-59	210-0202-00			1	TERMINAL,LUG:0.146 ID,LOCKING,BRZ TIN PL	86928	A-373-158-2
					(ATTACHING PARTS)		
-60	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL	78189	511-061800-00
					(END ATTACHING PARTS)		
-61	334-3379-02			1	MARKER,IDENT:MARKED GROUND SYMBOL	22670	ORDER BY DESCR
-62	407-2729-00			1	BRACKET,HEAT SK:ALUMINUM	TK2278	ORDER BY DESCR
					(ATTACHING PARTS)		
-63	211-0304-00			1	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,T9 TORX	01536	ORDER BY DESCR
-64	211-0303-00	B010100	B021074	2	SCREW,MACHINE:4-40 X 0.25,FLH 100 DEG,STL	TK1543	ORDER BY DESCR
	211-0379-00	B021075		2	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9	80009	211-0379-00
					(END ATTACHING PARTS)		
-65	211-0302-00			1	SCR,ASSEM WSHR:4-40 X 0.75,PNH,STL,TORX DR	01536	ORDER BY DESCR
-66	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-67	342-0582-01			1	INSULATOR,PLATE:XSTR,CER,0.04 THK	80009	342-0582-01
-68	343-1025-00			1	RETAINER,XSTR:	TK1154	ORDER BY DESCR
-69	211-0691-00			1	SCREW,MACHINE:6-32 X 0.625,PNH,STL	TK0858	ORDER BY DESCR
-70	210-0408-00			1	NUT,PLAIN,HEX:6-32 X 0.312,BRS CD PL	73743	3040-402
-71	342-0555-00			1	INSULATOR,PLATE:HEAT SINK,ALUMINA	80009	342-0555-00
-72	343-0969-00			1	RETAINER,XSTR:	80009	343-0969-00
-73	361-1047-00			1	SPACER,VAR RES:0.3 X 0.615 X 0.55,PLSTC	TK2165	ORDER BY DESCR
-74	441-1536-01	B010100	B028579	1	CHASSIS,SCOPE:REAR,L FRAME	TK2278	ORDER BY DESCR
	441-1536-02	B028580		1	CHASSIS,SCOPE:REAR,L FRAME	TK2278	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-1	334-4251-00			1	MARKER,IDENT:MKD CAUTION	07416	ORDER BY DESCR
-2	337-2773-00	B010100	B012979	1	SHIELD,ELEC:POWER SUPPLY,LOWER,PLSTC	80009	337-2773-00
	337-2773-02	B012980		1	SHIELD,ELEC:POWER SUPPLY,LOWER PLASTIC (ATTACHING PARTS)	80009	337-2773-02
-3	211-0305-00			1	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,CD PL (END ATTACHING PARTS)	01536	ORDER BY DESCR
-4	366-1480-03			1	PUSH BUTTON:BLACK,OFF (FOR CORRECT CONFIGURATION SEE FIG. 2)	80009	366-1480-03
-5	384-1576-01			1	EXTENSION SHAFT:12.544 L,PLASTIC	80009	384-1576-01
-6	200-2735-00			1	COVER,POWER SW:BLACK,POLYCARBONATE	TK2165	ORDER BY DESCR
-7	----- -----			1	SWITCH,PUSH:DPDT,4A,250VAC,W/BRKT (SEE A1S901 REPL)		
-8	377-0512-00			5	INSERT,KNOB:0.125 ID X 0.247 OD X 0.663,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 BRZ GLD PL	22526	48283-036
-11	131-0499-00			3	.TERMINAL,STUD:0.61 L,INSULATED	98291	013-1008-000-479
-12	----- -----			1	CKT BOARD ASSY:MAIN (SEE A1 REPL)		
-13	----- -----			3	.TERMINAL PIN:(SEE A1P9644 REPL)		
-14	----- -----			2	.TERMINAL,PIN:(SEE A1TP940,950 REPL)		
-15	343-0008-00			1	.CLAMP,LOOP:0.75 ID,PLASTIC	06915	E12 (CLEAR)
	119-1731-00			1	.DEFL LEAD ASSY:RESISTOR & CABLE .(SEE R9272,W9272 REPL)	80009	119-1731-00
	119-1732-00			1	.DEFL LEAD ASSY:RESISTOR & CABLE .(SEE R9273,W9373 REPL)	80009	119-1732-00
-16	337-3014-00	B010100	B027736	1	SHIELD,ELEC:ATTENUATOR TOP	TK2278	ORDER BY DESCR
	337-3201-02	B027737	B029669	1	SHIELD,ELEC:TOP,2230	TK2278	ORDER BY DESCR
	337-3201-03	B029670		1	SHIELD,ELEC:TOP,2200 (ATTACHING PARTS)	80009	337-3201-03
-17	211-0325-00			1	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-17.1	211-0325-00	B027737		3	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-18	211-0326-00			2	SCREW,MACHINE:4-40 X 1.25,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-19	----- -----			1	CKT BOARD ASSY:ATTENUATOR(SEE A2 REPL) (ATTACHING PARTS)		
-20	211-0305-00	B010100	B027736	1	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,CD PL	01536	ORDER BY DESCR
	211-0332-00	B027737		1	SCR,ASSEM WSHR:4-40 X 0.5,PNH,STL,T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
-21	361-1191-00	B010100	B027736	1	SPACER,CKT BD:0.222 X 0.125 X 0.25,	TK2165	ORDER BY DESCR
	361-1166-00	B027737		1	SPACER,SLEEVE:0.228 L X 0.162 ID,BRS	80009	361-1166-00
-22	211-0325-00			1	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
					ATTENUATOR BOARD ASSEMBLY INCLUDES:		
	136-0727-00	B016150	B027979	2	.SKT,PL-IN ELEK:MICROCKT,8 CONTACT	09922	DILB8P-108
-23	384-1056-00			2	.EXTENSION SHAFT:6.58 L X 0.123 OD,EPOX GL	TK2278	ORDER BY DESCR
-24	401-0370-00	B010100	B012979	2	.BEARING,CAM SW:END,0.6 DIA	80009	401-0370-00
	401-0370-01	B012980		2	.BEARING,CAM SW:END,0.6 DIA (ATTACHING PARTS)	80009	401-0370-01
-24.1	211-0325-00	B027737		2	.SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
	361-1300-00	B012980		1	.SPACER,BEARING:0.115 ID X 0.2 OD,BRASS	TK2278	ORDER BY DESCR
-25	210-0406-00			4	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-26	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:0.7 X 0.125,CU BE RED CLR	80009	214-1126-02
-27	214-1752-00			8	.ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-28	401-0369-00			2	.BEARING,CAM SW:CENTER,0.6 DIA (ATTACHING PARTS)	80009	401-0369-00
-29	211-0325-00			2	.SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
-30	105-0934-00	B010100	B016089	2	.ACTUATOR,CAM SW:AC-GND-DC	80009	105-0934-00
	105-0934-01	B016090		2	.ACTUATOR,CAM SW:AC-GND-DC	80009	105-0934-01
-31	105-0935-00	B010100	B016089	2	.ACTUATOR,CAM SW:ATTENUATOR	80009	105-0935-00
	105-0935-01	B016090		2	.ACTUATOR,CAM SW:ATTENUATOR	80009	105-0935-01
	376-0209-00			2	.CPLG,SHAFT,RGD:0.127 ID,PLASTIC	80009	376-0209-00
-32	343-1020-00			2	.RETAINER,CONT:ABS GRAY (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-33	211-0325-00			4	.SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
-34	131-1758-11			2	.CONT ASSY,ELEC:8 CONTACTS	TK2165	ORDER BY DESCR
	131-1758-12			2	.CONT ASSY,ELEC:8 CONTACTS	TK2165	ORDER BY DESCR

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-35	361-1193-00	B010100	B027736	2	.SPACER,SLEEVE:0.555 L X 0.13 ID,BRS	TK2278	ORDER BY DESCR
	361-1218-00	B027737		2	.SPACER,SLEEVE:0.738 L X 0.13 ID,BRS	TK2278	ORDER BY DESCR
	131-1758-12			2	CONT ASSY,ELEC:8 CONTACTS	TK2165	ORDER BY DESCR
-36	129-0986-00	B010100	B027736	1	SPACER,POST:0.776 L,4-40 BOTH ENDS,AL	TK2278	ORDER BY DESCR
	129-0988-00	B027737		1	SPACER,POST:0.966 L,4-40 EA END,AL	TK2278	ORDER BY DESCR
-37	----- -----			1	CKT BOARD ASSY:TIMING(SEE A4 REPL) (ATTACHING PARTS)		
-38	211-0325-00			3	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
					TIMING BOARD ASSEMBLY INCLUDES:		
-39	----- -----			17	.TERMINAL PIN:(SEE A4P9700,9705 REPL)		
-40	337-2944-00	B010100	B027736	1	SHIELD,ELEC:SW BOARDS,BOTTOM	TK2278	ORDER BY DESCR
	337-3291-00	B027737	B029592	1	SHIELD,ELEC:SW BD,BOTTOM	TK2278	ORDER BY DESCR
	337-3291-01	B029593		1	SHIELD,ELEC:BOTTOM,2200	80009	337-3291-01
-41	210-0406-00			2	NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL	73743	12161-50
-42	129-0906-00			2	SPACER,POST:0.685 L,4-40 INT/EXT,AL	TK2278	ORDER BY DESCR
-43	129-0999-00			1	SPACER,POST:0.485 L,4-40 INT/EXT,STL	TK2278	ORDER BY DESCR

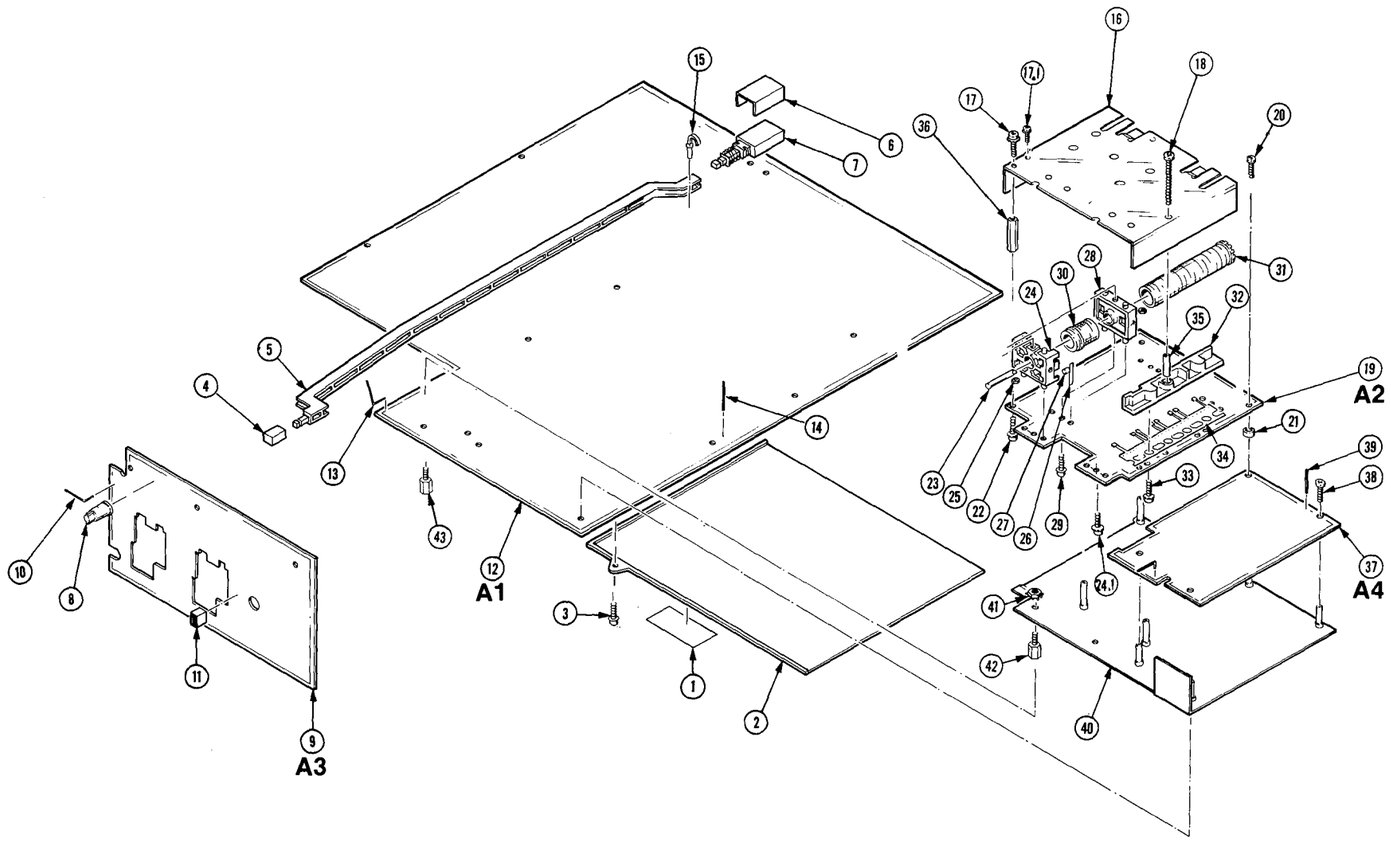


FIG. 3 ATTENUATOR ASSY. & BOTTOM

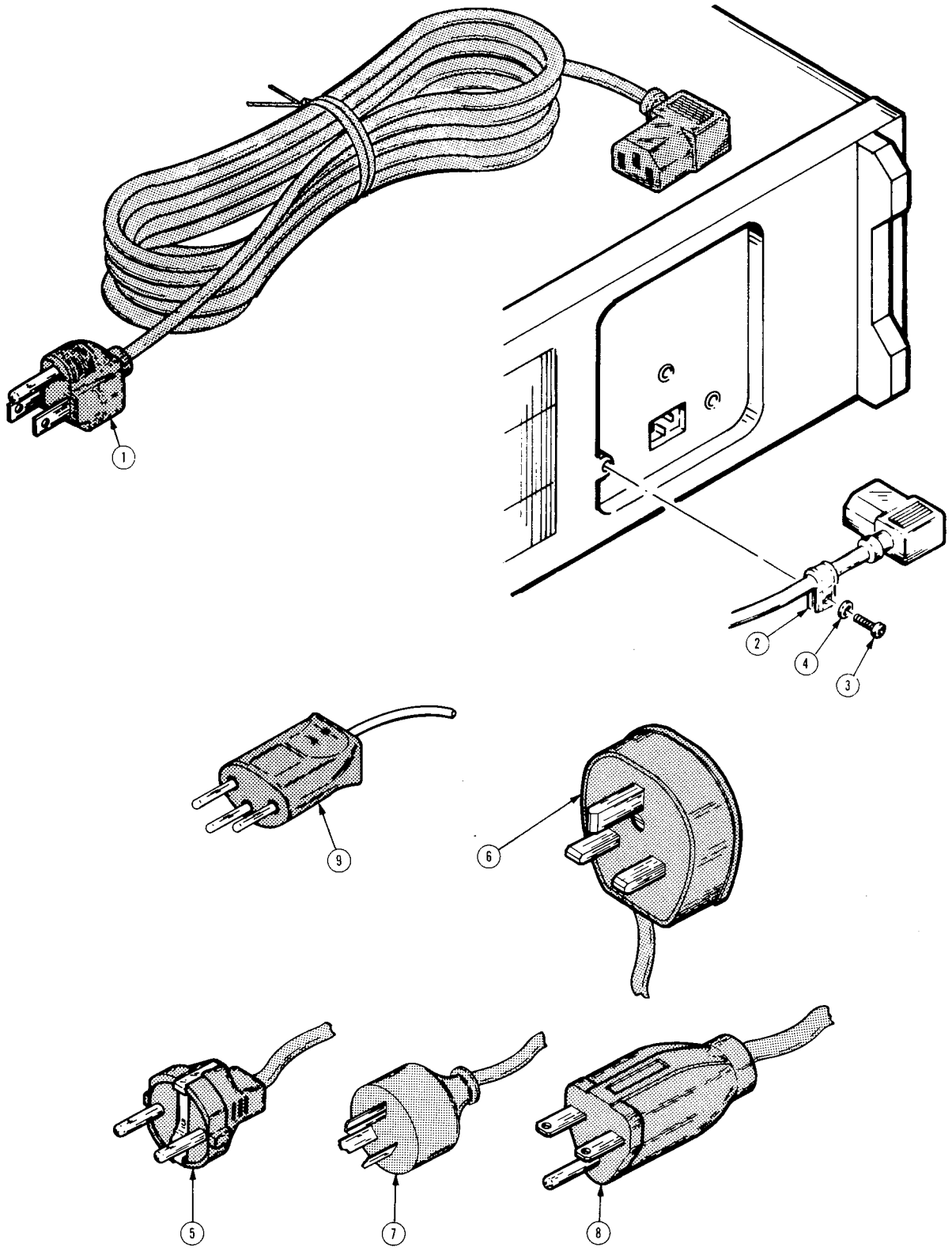


FIG. 4 ACCESSORIES

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345	Name & Description	Mfr. Code	Mfr. Part No.
4-								
						STANDARD ACCESSORIES		
	----- -----			2		ACCESSORY PKG:TWO P6109 OPT 01 PROBES		
	159-0019-00			1		FUSE,CARTRIDGE:3AG,1A,250V,SLOW BLOW	71400	MDL 1
-1	161-0104-00	B010100	B027151	1		CABLE ASSY,PWR,:3 WIRE,98.0 L,W/RTANG CONN	16428	CH8352, FH-8352
	161-0230-01	B027152		1		CABLE ASSY,PWR,:3,18 AWG,92.0 L	80009	161-0230-01
-2	343-0003-00			1		CLAMP,LOOP:0.25 ID,PLASTIC	06915	E4 CLEAR ROUND
-3	213-0882-00			1		SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	83385	ORDER BY DESCR
-4	210-0803-00			1		WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
	070-4734-00			1		MANUAL,TECH:OPERATORS,2213A	80009	070-4734-00
						OPTIONAL ACCESSORIES		
	020-0859-00			1		COMPONENT KIT:EUROPEAN	80009	020-0859-00
	343-0170-00	B025442		1		.RTNR,CA TO CA:U/W 0.25 OD CABLES	80009	343-0170-00
	200-2265-00			1		.CAP,FUSEHOLDER:5 X 20MM FUSES	TK0861	FEK 031.1663
-5	161-0104-06			1		.CABLE ASSY,PWR,:3 X 0.75MM SQ,220V,98.0 L	S3109	ORDER BY DESCR
	020-0860-00			1		COMPONENT KIT:UNITED KINGDOM	80009	020-0860-00
	343-0170-00	B025442		1		.RTNR,CA TO CA:U/W 0.25 OD CABLES	80009	343-0170-00
	200-2265-00			1		.CAP,FUSEHOLDER:5 X 20MM FUSES	TK0861	FEK 031.1663
-6	161-0104-07			1		.CABLE ASSY,PWR,:3 X 0.75MM SQ,240V,98.0 L	TK1373	A25UK-RA
	020-0861-00			1		COMPONENT KIT:AUSTRALIAN	80009	020-0861-00
	343-0170-00	B025442		1		.RTNR,CA TO CA:U/W 0.25 OD CABLES	80009	343-0170-00
	200-2265-00			1		.CAP,FUSEHOLDER:5 X 20MM FUSES	TK0861	FEK 031.1663
-7	161-0104-05			1		.CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L	S3109	ORDER BY DESCR
	020-0862-00			1		COMPONENT KIT:NORTH AMERICAN	80009	020-0862-00
	343-0170-00	B025442		1		.RTNR,CA TO CA:U/W 0.25 OD CABLES	80009	343-0170-00
	200-2265-00			1		.CAP,FUSEHOLDER:5 X 20MM FUSES	TK0861	FEK 031.1663
-8	161-0104-08			1		.CABLE ASSY,PWR,:3,18 AWG,240V,98.0 L	70903	ORDER BY DESCR
	020-0863-00			1		COMPONENT KIT:SWISS	80009	020-0863-00
	343-0170-00	B025442		1		.RTNR,CA TO CA:U/W 0.25 OD CABLES	80009	343-0170-00
	200-2265-00			1		.CAP,FUSEHOLDER:5 X 20MM FUSES	TK0861	FEK 031.1663
-9	161-0167-00			1		.CABLE ASSY,PWR,:3.0 X 0.75,6A,240V,2.5M L	S3109	ORDER BY DESCR
	013-0191-00			1		TIP,PROBE:W/ACTUATOR	80009	013-0191-00
	016-0466-00			1		ADAPTER,RACK:	80009	016-0466-00
	016-0792-01			1		CASE,CARRYING:24.5 X 16.5 X 11.5	TK1336	ORDER BY DESCR
	016-0848-00			1		COVER,PROT:WATERPROOF VINYL	80009	016-0848-00
	346-0199-00			1		STRAP,CARRYING:MKD TEKTRONIX	80009	346-0199-00
	020-0672-02			1		ACCESSORY KIT:	80009	020-0672-02
	016-0677-02			1		.POUCH,ACCESSORY:	TK0174	016-0677-02
	200-2520-00			1		.COVER,SCOPE:FRONT,ABS	TK2165	ORDER BY DESCR
	070-4733-00			1		MANUAL,TECH:SERVICE,2213A	80009	070-4733-00

Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 3-22-89 Change Reference: M65992

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE ALL SERIAL NUMBERS

The 2213A is now available with Option 33 for rough service. See below for a complete desription.

OPTION 33

Option 33, the **Travel Line** option, provides impact protection needed for rough industrial and service environments. When the instrument is ordered with Option 33, the instrument comes equipped with the Accessory Pouch and the Front Panel Cover, front and rear mounted shock absorbing rubber guards, an easy-to-use power cord wrap, and a carrying strap.

REPLACEABLE MECHANICAL PARTS LIST CHANGES

ADD:

Part Number	Qty	Name & Description
390-0790-15	1	CABINET,ASSY: W/BUMPER & HANDLE (OPTION 33)
		INCLUDES
200-2538-33	1	.COVER ASSY: REAR,W/RUBBER BUMPER
212-0144-00	2	.SCREW,TPG,TF: 8-16 X 0.562 L,PLASTITE,SPCL HD,CD PL,TORX
367-0289-00	1	.HANDLE,CARRYING:
390-0790-13	1	.CABINET,SCOPE: W/BUMPER

Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 2-12-89 Change Reference: M67697

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029497

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A6	670-7615-01	CIRCUIT BD ASSY: EMI FILTER

FIGURE CHANGES

Replace Figure 9-12 (A6 Filter board) with the new figure shown here.

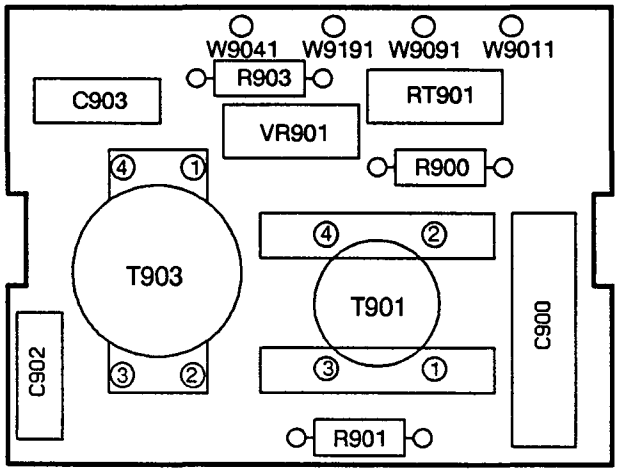
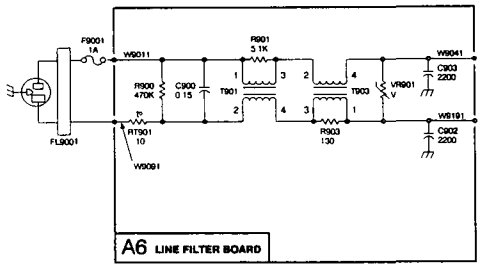


DIAGRAM CHANGES

DIAGRAM 6 POWER SUPPLY, Z AXIS & CRT

Replace the filter Board section of schematic with the schematic shown here. Location is 5B.



Tektronix®
COMMITTED TO EXCELLENCE

MANUAL CHANGE INFORMATION

Date: 3-14-89 Change Reference: M68308

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029678

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1	670-7520-07	CIRCUIT BD ASSY: MAIN
A1Q946	151-0852-00	TRANSISTOR: NPN,50V,150MA,200MW
A1Q947	151-0852-00	TRANSISTOR: NPN,50V,150MA,200MW
A1R908	315-0222-00	RES,FXD,FILM: 2.2K OHM,5%,0.25W

CHASSIS PARTS

CHANGE TO:

Q9070	151-1245-00	TRANSISTOR: MOSFET,N-CHAN,TO-220

DIAGRAM CHANGES

DIAGRAM  **POWER SUPPLY, Z AXIS & CRT**

Change the value of resistor R908 (location 8H) to 2.2 KΩ.

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MANUAL CHANGE INFORMATION

Date: 3-13-89 Change Reference: M68614

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029590

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A2R6	315-0105-03	RES,FXD,FILM: 1M OHM,5%,0.25W
A2R56	315-0105-03	RES,FXD,FILM: 1M OHM,5%,0.25W

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MANUAL CHANGE INFORMATION

Date: 12-08-89 Change Reference: M68665, M69178

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B020110

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHASSIS PARTS

CHANGE TO:

R9615	311-2158-03	RES VAR: W: PNL 5K OHM, 5% W RIBBON CABLE

REPLACEABLE MECHANICAL PARTS LIST

OPTIONAL ACCESSORIES (M69178)

DELETE:

013-0191-00	TIP, PROBE: W ACTUATOR

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MANUAL CHANGE INFORMATION

Date: 1-16-90 Change Reference: M68743 (REV)

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029903

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

ASSEMBLY A1

CHANGE:

C228	283-0698-00	CAP, FXD, MICA,390 pF 1%, 500V
C229	283-0698-00	CAP, FXD, MICA,390 pF 1%, 500V
C381	283-0637-00	CAP, FXD, MICA, 20 pF, 2.5%, 500V

ASSEMBLY A3

CHANGE:

C377	281-0577-00	CAP, FXD, CER, 14 pF, 5%, 500V
C379	283-0644-00	CAP, FXD, MICA, 150 pF, 1%, 500V

EFFECTIVE SERIAL NUMBER: B029728

ASSEMBLY A3

CHANGE:

C380	283-0637-00	CAP, FXD, MICA, 20 pF, 2.5%, 500V

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MANUAL CHANGE INFORMATION

Date: 12-21-89 Change Reference: M68743 (REV)

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

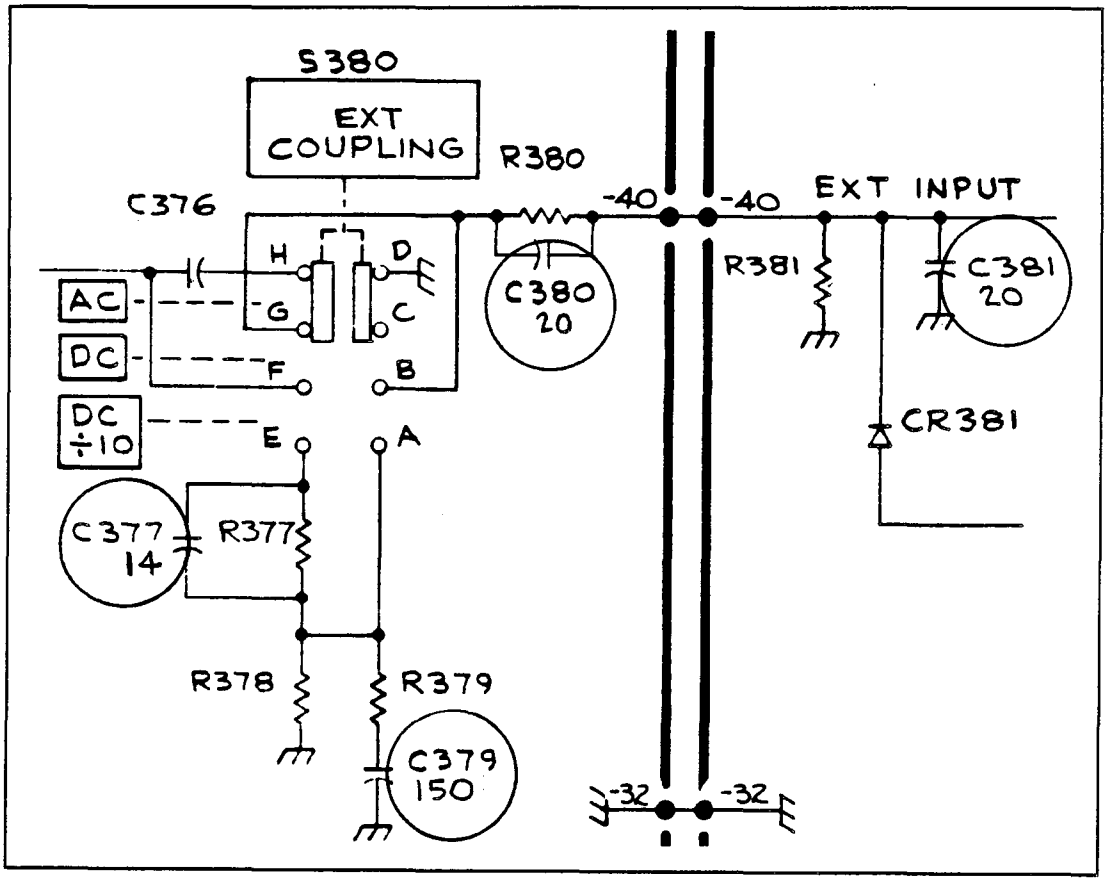
DIAGRAM CHANGES

DIAGRAM 2 VERTICAL PREAMP & OUTPUT AMPL

Change the Value of capacitor C240 (22 pF), grid location 5M.

DIAGRAM 3 TRIGGERING

Change the Value of capacitor C377 (14 pF), grid location 5B.
Change the Value of capacitor C379 (150 pF), grid location 5B.
Change the Value of capacitor C380 (20 pF), grid location 4B.
Change the Value of capacitor C381 (20 pF), grid location 4B.



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MANUAL CHANGE INFORMATION

Date: 02-09-90 Change Reference: M69525

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029945

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

A4 TIMING BOARD

CHANGE:

S701	260-2024-03	SWITCH, ROTARY: A SWEEP

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MANUAL CHANGE INFORMATION

Date: 1-3-90 Change Reference: M70652

Product: 2213A SERVICE Manual Part Number: 070-4733-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B029945

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

V9870	154-0861-10	ELECTRON TUBE