2235A

PORTABLE OSCILLOSCOPE INSTRUCTION

WARNING

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

Please Check for CHANGE INFORMATION at the Rear of This Manual

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Dave & Lynn Henderson
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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 two digits designates the country of manufacture. The last five digits of the serial number 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, U.S.A.
HK00000	Tektronix, Inc., Hong Kong
G100000	Tektronix Guernsey, Ltd., Channel Islands
E200000	Tektronix United Kingdom, Ltd., Marlow
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Certificate of the Manufacturer/Importer

We hereby certify that the 2235A OSCILLOSCOPE AND ALL INSTALLED OPTIONS complies with the RF Interference Suppression requirements of Amtsbl.-Vfg 1046/1984.

The German Postal Service was notified that the equipment is being marketed.

The German Postal Service has the right to re-test the series and to verify that it complies.

TEKTRONIX

Bescheinigung des Herstellers/Importeurs

Hiermit wird bescheinigt, daß der/die/das 2235A OSCILLOSCOPE AND ALL INSTALLED OPTIONS in Übereinstimmung mit den Bestimmungen der Amtsblatt-Verfugüng 1046/1984 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur Überprufüng der Serie auf Einhalten der Bestimmungen eingeräumt.

TEKTRONIX

NOTICE to the user/operator:

The German Postal Service requires that systems assembled by the operator/user of this instrument must also comply with Postal Regulation, Vfg. 1046/1984, Par. 2, Sect. 1.

HINWEIS für den Benutzer/Betreiber:

Die vom Betreiber zusammengestellte Anlage, innerhalb derer dies Gerät eingesetzt wird, muß ebenfalls den Voraussetzungen nach Par. 2, Ziff. 1 der Vfg. 1046/1984 genugen.

NOTICE to the user/operator:

The German Postal Service requires that this equipment, when used in a test setup, may only be operated if the requirements of Postal Regulation, Vfg. 1046/1984, Par. 2, Sect. 1.7.1 are complied with.

HINWEIS für den Benutzer/Betreiber:

Dies Gerät darf in Meßaufbauten nur betrieben werden, wenn die Voraussetzungen des Par. 2, Ziff. 1.7.1 der Vfg. 1046/1984 eingehalten werden.

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LIST OF TABLES

OPERATORS SAFETY SUMMARY

The safety information in this summary is for operating personnel. Warnings and cautions will also be found throughout the manual where they apply.

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 V 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 making any connections 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 2-2.

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 an Explosive Atmosphere

To avoid explosion, do not operate this instrument in an explosive atmosphere.

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.

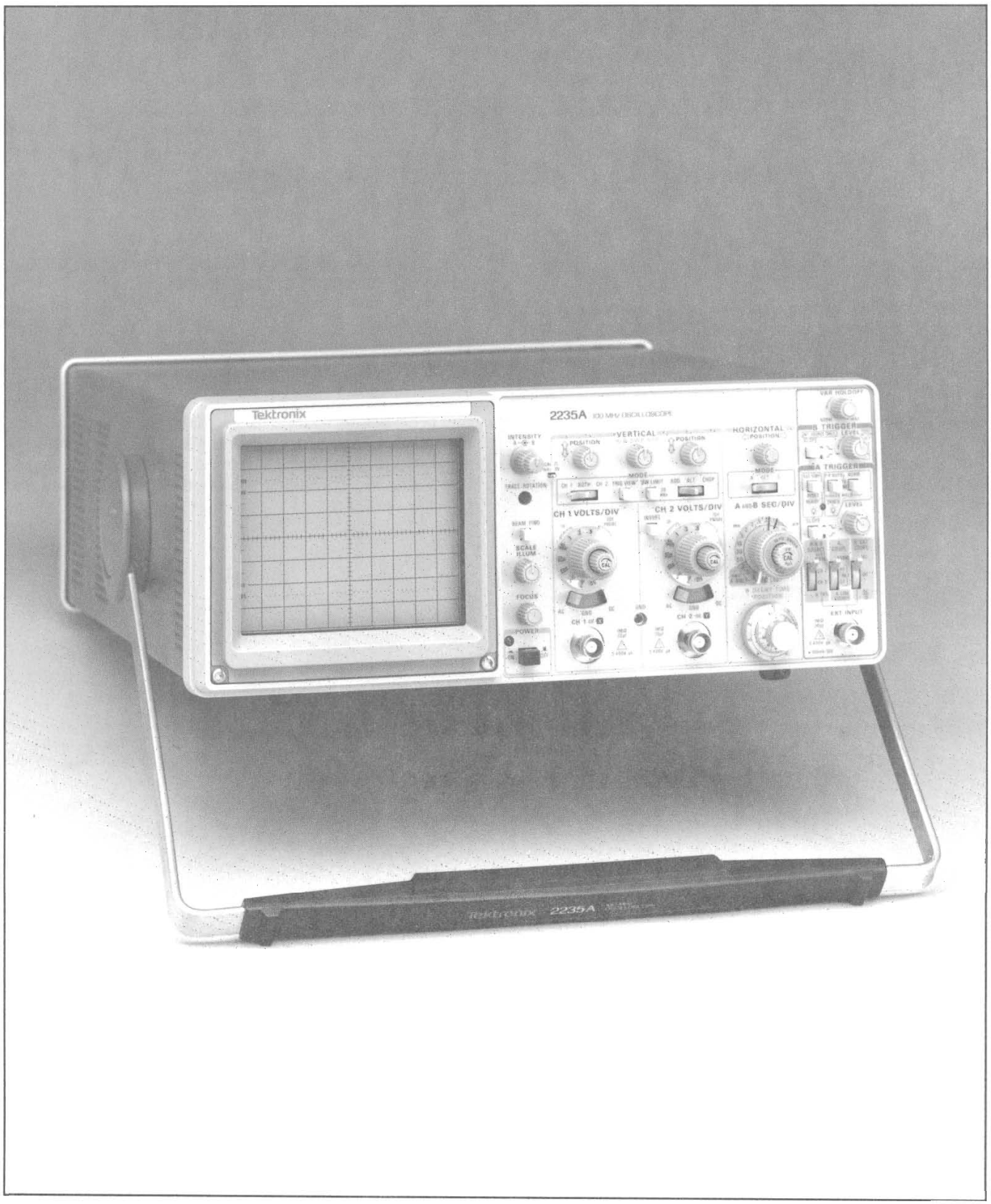
Use Care When Servicing With Power On

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.



7683-12

The 2235A Oscilloscope.

SPECIFICATION

INTRODUCTION

The TEKTRONIX 2235A Oscilloscope is a rugged, lightweight, dual-channel, 100 MHz instrument that features a bright, sharply defined trace on an 80- by 100-mm cathode-ray tube (crt). Its vertical system supplies calibrated deflection factors from 2 mV per division to 5 V per division. Trigger circuits enable stable triggering over the full bandwidth of the vertical system. The horizontal system provides calibrated sweep speeds from 0.5 s per division to 50 ns per division along with delayed-sweep features. A X10 magnifier circuit extends the maximum sweep speed to 5 ns per division when the A and B SEC/DIV switch is set to 0.05 μs per division.

ACCESSORIES

The instrument is shipped with the following standard accessories:

1	Instruction manual
2	10X Probes with accessories
1	Power cord
1	Power cord clamp
1	Flat washer
1	Self-tapping screw
1	Fuse

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 2235A 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 that define the measurement capabilities of the instrument.

Environmental characteristics are given in Table 1-2. The 2235A 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 noted otherwise.

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

Table 1-1
Electrical Characteristics

Characteristics	Performance Requirements
VERTICAL DEFLECTION SYSTEM	
Deflection Factor	
Range	2 mV per division to 5 V per division in a 1-2-5 sequence.
Accuracy	
+15°C to +35°	±2%.
0°C to +50°C	±3%.[a] For 5 mV per division to 5 V per division VOLTS/DIV switch settings, the gain is set at a VOLTS/DIV switch setting of 10 mV per division. 2 mV per division gain is set with the VOLTS/DIV switch set to 2 mV per division.
Range of VOLTS/DIV Variable Control	Continuously variable between settings. Increases deflection factor by at least 2.5 to 1.
Step Response	
Rise Time	
+10°C to +35°	
5 mV per Division to 5 V per Division	3.5 ns or less.[a]
2 mV per Division	3.9 ns or less.[a]
+35°C to +50°	
5 mV per Division to 5 V per Division	3.9 ns or less.[a]
2 mV per Division	4.4 ns or less.[a] Rise time is calculated from the formula: $\frac{0.35}{\text{Bandwidth (-3 dB)}}$
Bandwidth (-3 dB)	
+0°C to +35°	
5 mV per Division to 5 V per Division	Dc to at least 100 MHz.
2 mV per Division	Dc to at least 90 MHz.

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

Table 1-1 (cont)

Characteristics	Performance Requirements
Bandwidth (-3 dB) (cont)	
+35°C to +50°	
5 mV per Division to 5 V per Division	Dc to at least 90 MHz.[a]
2 mV per Division	Dc to at least 80 MHz.[a] 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.
AC Coupled Lower Limit	10 Hz or less at -3 dB.[a]
Bandwidth Limiter	Upper limits (-3 dB) bandpass at 20 MHz ±10%.
AC Coupled Lower Cutoff Frequency	10 Hz or less at -3 dB.[a]
Chop Mode Switching Rate	500 kHz ±30%.[a]
Input Characteristics	
Resistance	1 MΩ ±2%.[a]
Capacitance	20 pF ±2 pF.[a]
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 10 to 1 at 50 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.
Input Current	1 nA or less (0.5 division or less trace shift when switching between DC and GND input coupling with the VOLTS/DIV switch at 2 mV per division).[a]
Trace Shift with Volts/Div Switch 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 50 MHz.
POSITION Control Range	At least ±11 division from graticule center.

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

Table 1-1 (cont)

Characteristics	Performance Requirements
TRIGGER SYSTEM	
A TRIGGER Sensitivity	
P-P AUTO/TV and NORM Modes (A TRIG BW switch in FULL position)	**10 MHz** / **60 MHz** / **100 MHz**
Internal	0.35 div / 1.0 div / 1.5 div
External	35 mV / 120 mV / 150 mV
	External trigger signal from a 50 Ω source driving a 50 Ω coaxial cable terminated in 50 Ω at the input connector.
HF REJ	Reduces trigger signal amplitude at high frequencies by about 20 dB with rolloff beginning 40 kHz ±25%.[a]
LF REJ	Attenuates signals below 40 kHz (-3 dB point at 40 kHz ±25%).[a]
Lowest Usable Frequency in P-P AUTO Mode	20 Hz with 1.0 division internal or 100 mV external.[a]
TV LINE (Sync Amplitude)	**Internal[a]** / **External[a]**
	0.35 div / 35 mV p-p
TV FIELD Mode	≥1 division of composite sync.[a]
B TRIGGER Sensitivity (Internal Only)	**10 MHz** / **60 MHz** / **100 MHz**
	0.35 div / 1.0 div / 1.5 div
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 Lower Cutoff	10 Hz or less at lower -3 dB point.[a]
Offset	25 mV or less.
LEVEL Control Range	
A TRIGGER (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]
B TRIGGER (Internal)	Can be set to any point of the trace that can be displayed.[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
LEVEL Control Range (cont)	
Trigger View System	
Deflection Factor	
Internal	Same as vertical.
External	
AC and DC	100 mV per division.
DC ÷ 10	1 V per division.
Accuracy	±20%.
Delay Difference Between EXT INPUT and Either Vertical Channel	Less than 3.0 ns.[a]
HORIZONTAL DEFLECTION SYSTEM	
Sweep Rate	
Calibrated Range	
A Sweep	0.5 s per division to 0.05 μs per division in a 1-2-5 sequence of 22 steps. X10 magnifier extends maximum sweep speed to 5 ns per division.
B Sweep	50 ms per division to 0.05 μs per division in a 1-2-5 sequence of 19 steps. X10 magnifier extends maximum sweep speed to 5 ns per division.
Accuracy	**Unmagnified** / **Magnified**
+10°C to +35°C	±2% / ±3%
0°C to +50°C	±3% / ±4%
	Sweep accuracy applies over the center 8 divisions. Exclude the first 25 ns of the sweep for the X10 magnified sweep speeds and anything beyond the 100th magnified division.
POSITION Control Range	Start of sweep to 10th division will position past the center vertical graticule line in X1 or 100th division in X10.
Sweep Linearity	±5%. 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 of the X10 magnified sweeps.
Variable Control Range	Continuously variable between calibrated settings of the SEC/DIV control. Extends the A and the B Sweep speeds by at least a factor of 2.5 times over the calibrated SEC/DIV switch settings.
Sweep Length	Greater than 10 division.

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

Table 1-1 (cont)

Characteristics	Performance Requirements
A/B SWP SEP Range	±3.5 divisions or greater.
Delay Time	Applies to 0.5 μs per division and slower. Delay time is functional but not calibrated at A sweep speeds above 0.5 μs per division.
Dial Control Range	<0.5 +300 ns to >10 divisions.
Jitter	One part or less in 20,000 (0.005%) of the maximum available delay time.
Differential Time Measurement Accuracy	
+15°C to +35°C	±1% +0.01 major dial division.
0°C to +50°C	±2% +0.01 major dial division.[a] Exclude delayed operation when A and B SEC/DIV knobs are locked together at any sweep speed or when A SEC/DIV switch is faster than 0.5 μs per division. Accuracy applies over the B DELAY TIME POSITION control range.
X-Y OPERATION (X1 MAGNIFICATION)	
Deflection Factors	Same as Vertical Deflection System with the VOLTS/DIV Variable controls in CAL detent positions.
Accuracy	
X-Axis	
+15°C to 35°C	±3%.
0°C to +50°C	±4%.[a] Measured with a dc-coupled, 5-division reference signal.
Y-Axis	Same as Vertical Deflection System.[a]
Bandwidth (-3 dB)	
X-Axis	Dc to a least 2.5 MHz.
Y-Axis	Same as Vertical Deflection System.[a]
Phase Difference Between X- and Y-Axis Amplifiers	±3° from dc to 150 kHz. Vertical Input coupling set to DC.

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

Table 1-1 (cont)

Characteristics	Performance Requirements
PROBE ADJUST	
Output Voltage of PROBE ADJUST Jack	0.5 V ±2%.
Repetition Rate	1 kHz ±5%.[a]
Z-AXIS INPUT	
Sensitivity	5 V causes noticeable modulation. Positive-going input decreases intensity. Usable: frequency range is dc to 20 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	75 W (130 VA).[a]
Line Fuse	1.25 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
Environmental Requirements	Instrument meets or exceeds the environmental requirements of MIL-T-28800D for Type III, Class 5, Style D equipment as described below.
Temperature	
Operating	0°C to +50°C (+32°F to +122°F).
Nonoperating	-40°C to +71°C (-40°F to +160°F). Tested to MIL-T-28800D 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 (-40°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 4,570 m (15,000 ft). Maximum operating temperature decreased 1°C per 1,000 ft above 5,000 ft.
Nonoperating	To 15,240 m (50,000 ft). Exceeds requirements of MIL-T-28800D paragraph 4.5.5.2.
Humidity (Operating and Nonoperating)	5 cycles (120 hours) referenced to MIL-T-28800D 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 +30°C and +50°C for all modes of operation. Non-operating at +30°C to +60°C.
Radiated and Conducted Emission Requirements Per VDE 0871	Meets Class B.
Electrostatic Discharge	Withstands discharge of up to 20 kV. Test performed with probe containing a 500 pF capacitor with 1 KΩ series resistance charged to the test voltage. Conforms to Tektronix Standard 062-2862-00.
Vibration (Operating)	15 minutes along each of 3 major axis at a total displacement of 0.015 inch p-p (2.4 g's at 55Hz) 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 axis. All major resonances must be above 55 Hz. Meets requirements of MIL-T-28800D, paragraph 4.5.5.3.1.
Bench Handling Test (cabinet on and cabinet off)	Each edge lifted four inches and allowed to free fall onto a solid wooden bench surface. Meets requirements of MIL-T-28800D, paragraph 4.5.5.4.3.
Shock (Operating and Non-operating)	30 g's, half-sine, 11-ms duration, 3 shocks per axis each direction, for a total of 18 shocks. Meets requirements of MIL-T-28800D, paragraph 4.5.5.4.1, except limited to 30 g's.

Table 1-2 (cont)

Characteristics	Description
Transportation	
Packaged Vibration Test	Meets the limits of the National Safe Transit Association test procedure 1A-B-1; excursion of 1 inch p-p at 4.63 Hz (1.1 g) for 30 minutes on the bottom and 30 minutes on the side (for a total of 60 minutes).
Package Drop Test	Meets the limits of the National Safe Transit Association test procedure 1A-B-2; 10 drops of 36 inches.

Table 1-3
Physical Characteristics

Characteristics	Description
Weight	
With Accessories	9.1 kg (20.0 lb).
Without Accessories	6.1 kg (13.5 lb).
Domestic Shipping Weight	10.9 kg (24.1 lb).
Height	
With Pouch (Empty)	150 mm (5.9 in).
Without Pouch	137 mm (5.4 in).
Width	
With Handle	360 mm (14.2 in).
Without Handle	328 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).

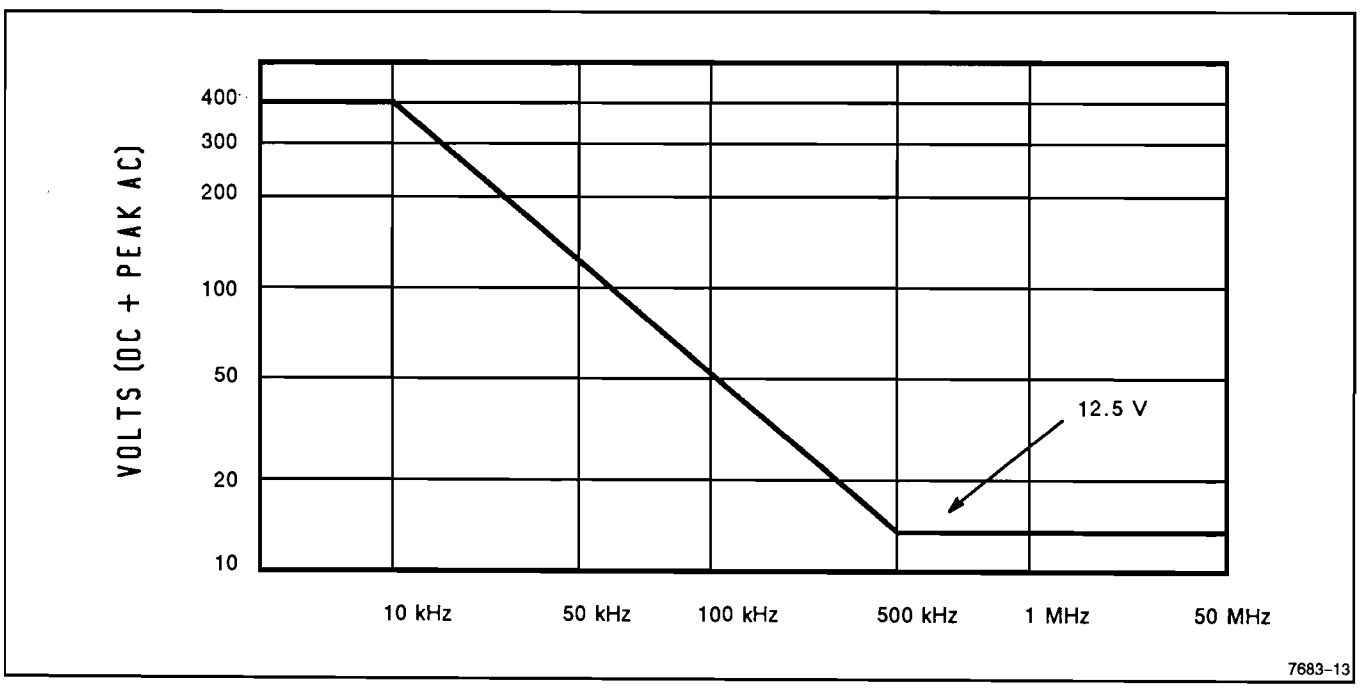


Figure 1-1. Maximum voltage versus frequency derating curve for the CH 1 OR X, CH 2 OR Y, and EXT INPUT OR Z connectors.

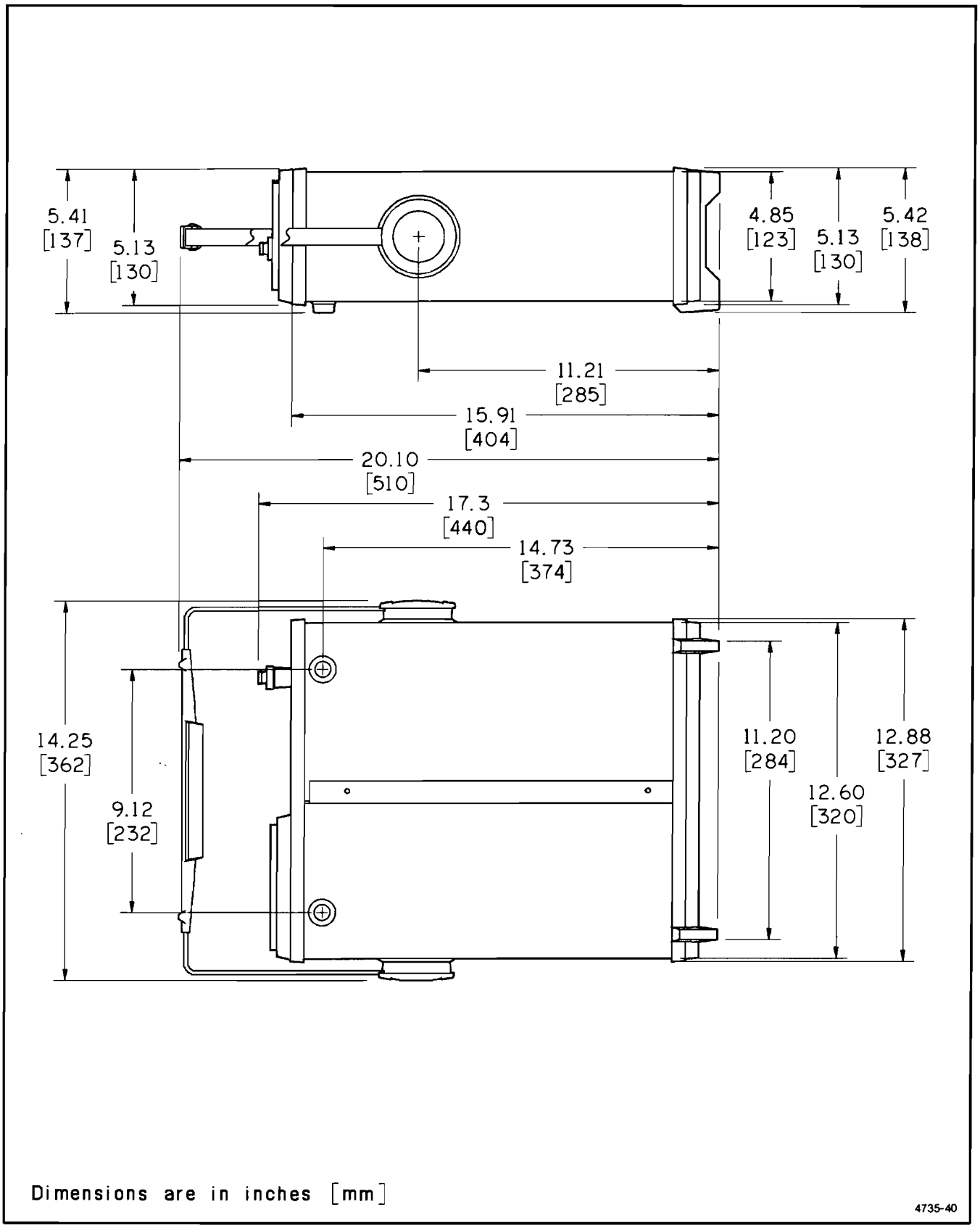


Figure 1-2. Physical dimensions of the 2235A Oscilloscope.

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 this instrument. 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. To secure the power cord to the instrument, use the power cord clamp as illustrated in Figure 2-1.

The instrument is shipped with the required power cord as ordered by the customer. Available power-cord information is illustrated in Figure 2-2, and part numbers are listed in Section 10 at the back of this manual. Contact your Tektronix representative or local Tektronix Field Office for additional power-cord information.

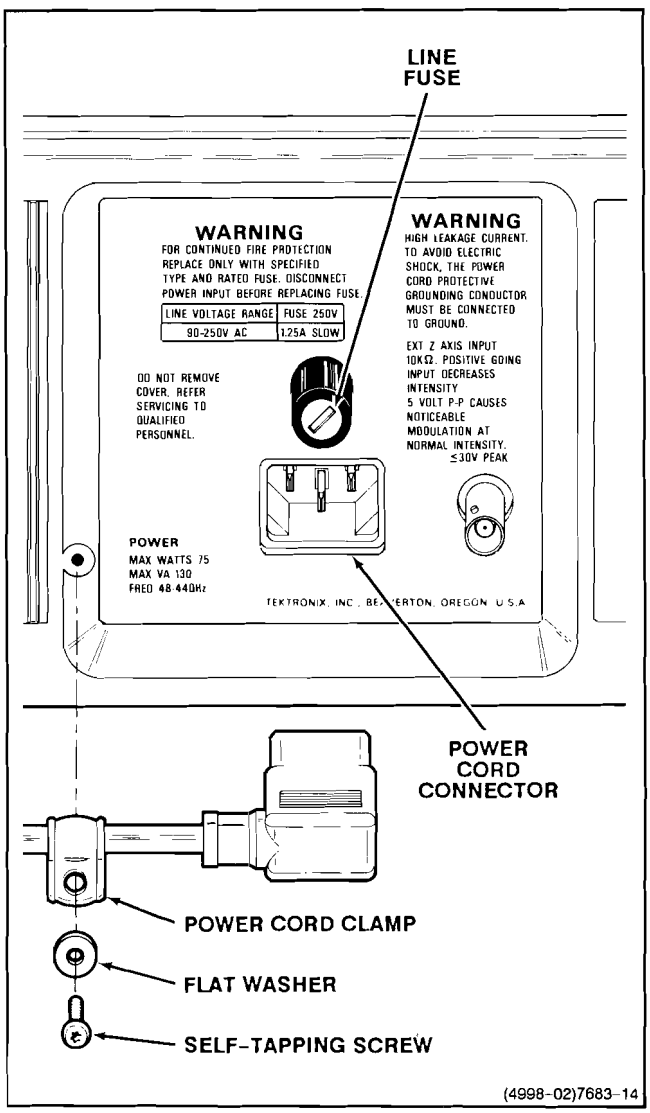


Figure 2-1. Securing the detachable power cord to the instrument.

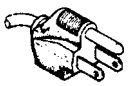
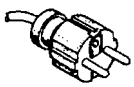
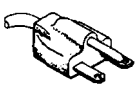
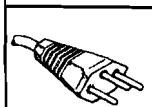
LINE FUSE

The instrument fuse holder is located on the rear panel (see Figure 2-1) 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.

4. Verify proper fuse value (1.25 A, 250 V, slow blow).

5. Reinstall the fuse (or replacement fuse) and the fuse-holder cap.

Plug Configuration	Option	Power Cord/ Plug Type	Line Voltage	Reference Standards [b]
	U.S. Std.	U.S. 120V	120V	ANSI C73.11 NEMA 5-15-P IEC 83 UL 198.6
	A1	EURO 220V	220V	CEE(7), II, IV, VII IEC 83 IEC 127
	A2	UK[a] 240V	240V	BS 1363 IEC 83 IEC 127
	A3	Australian 240V	240V	AS C112 IEC 127
	A4	North American 240V	240V	ANSI C73.20 NEMA 6-15-P IEC 83 UL 198.6
	A5	Switzerland 220V	220V	SEV IEC 127

[a] A 6A, type C fuse is also installed inside the plug of the Option A2 power cord.

[b] Reference Standards 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 – Schweizervischer Elektrotechnischer Verein
UL – Underwriters Laboratories Inc.

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Figure 2-2. Optional power cords.

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.

INSTRUMENT REPACKAGING

To ship an instrument, it is recommended that it be packaged in the original manner. The carton and packaging material in which the instrument was shipped should be saved and used for this purpose. The Accessory Pouch should be removed by a qualified service person before being shipped in the original carton.

If the original packaging is unfit for use or is not available, repackage the instrument as follows:

1. Obtain a corrugated cardboard shipping carton having inside dimensions at least six inches greater than the instrument dimensions and having a carton test strength of at least 275 pounds.

2. If the instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing the following: owner of the instrument (with address), the name of a person who can be contacted, complete instrument type and serial number, and a description of the service required.

3. Wrap the instrument with polyethylene sheeting or equivalent to protect the outside finish and prevent entry of packing materials into the instrument.

4. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument, allowing three inches on each side.

5. Seal the carton with shipping tape or with an industrial stapler.

6. Mark the address of the Tektronix Service Center and the return address on the carton in one or more prominent locations.

CONTROLS, CONNECTORS AND INDICATORS

DISPLAY AND POWER

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

(1) **Internal Graticule**—Eliminates parallax viewing error between 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) **SCALE ILLUM Control**—Adjusts the light level of the graticule illumination.

(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 horizontal graticule lines.

(8) **A and B INTENSITY Controls**—Determines the brightness of the A and B Sweep traces.

VERTICAL

Refer to Figure 2-4 for location of items 9 through 18.

(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.

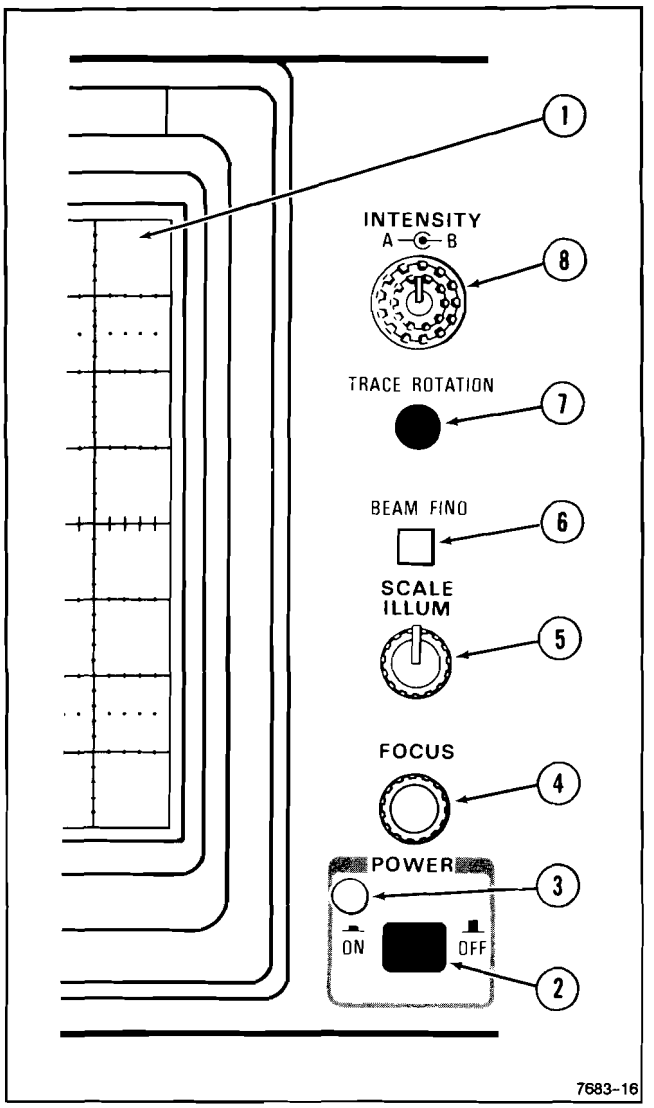


Figure 2-3. Power and display controls and indicator.

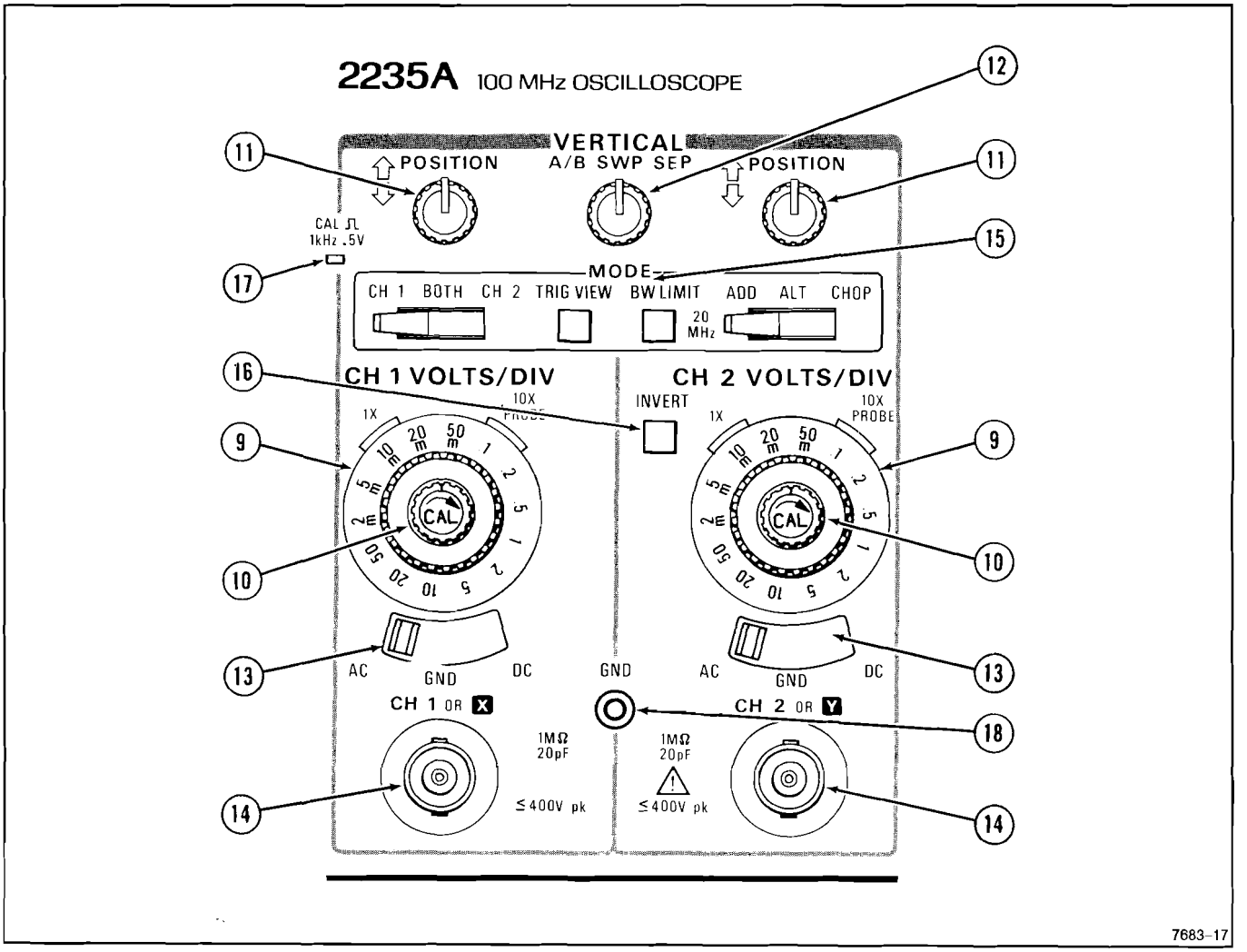


Figure 2-4. Vertical controls, connectors, and indicators.

(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) **A/B SWP SEP**—Vertically positions the B Sweep trace with respect to the A Sweep when ALT Horizontal MODE is selected.

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

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

(14) **CH 1 OR X and CH 2 OR Y Input Connectors** – Provide for application of external signals to the instrument 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).

(15) **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 weep. This mode is useful for viewing both input signals at sweep speeds from 0.05 us 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 about 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 s per division.

BW LIMIT – Limits the bandwidth of the vertical deflection system and the A Trigger system to about 20 MHz when the button is pressed in. Button must be pressed in a second time to release it and regain full 100-MHz bandwidth operation. Provides a method for reducing interference from high-frequency signals when viewing low-frequency signals.

TRIG VIEW – Press and hold the button in to display a sample of the signal present in the A Trigger amplifier (for all A & B SOURCE switch settings). All other signals displays are removed while the TRIG VIEW button is held in.

(16) **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 non-inverted display.

(17) **CAL ⎍ Connector** – Provides an 0.5 V, negative-going square-wave voltage at 1 kHz for compensating voltage probes and checking the operation of the oscilloscope's vertical system. It is not intended to verify the accuracy of the vertical and the horizontal deflection systems

(18) **GND Connector** – Provides direct connection to the instrument chassis ground.

HORIZONTAL

Refer to Figure 2-5 for location of items 19 through 25.

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

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

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

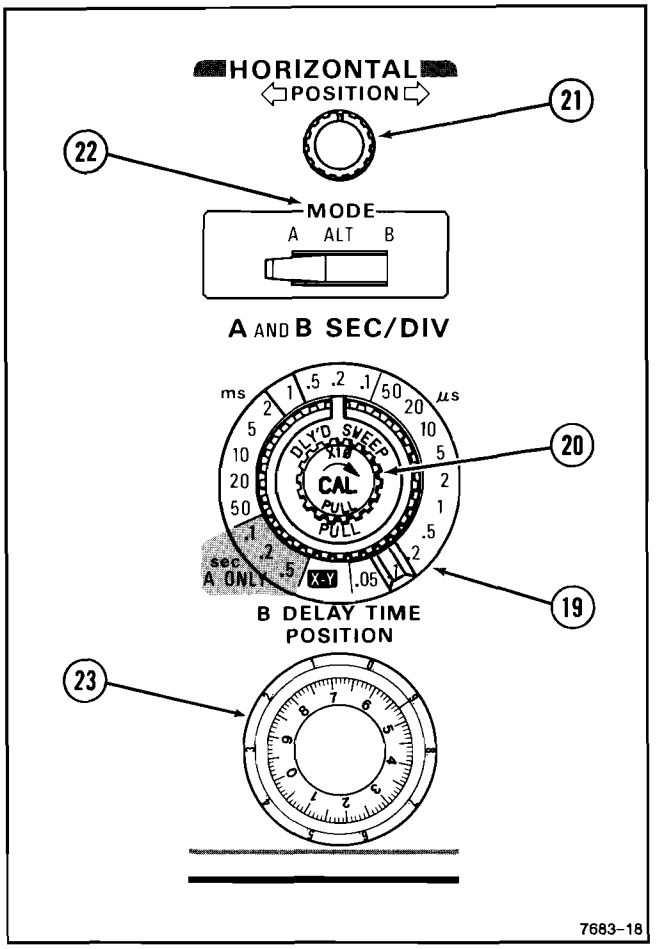


Figure 2-5. Horizontal controls and indicator.

(22) **Horizontal MODE Switch**—Determines the mode of operation for the horizontal deflection system.

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

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

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

(23) **B DELAY TIME POSITION Control**—Selects the amount of delay time between the start of the A sweep and the start of the B Sweep. Delay time is variable from 0.5 times to 10 times the A SEC/DIV switch setting.

TRIGGER

Refer to Figure 2-6 for location of items 24 through 34.

(24) **A TRIGGER Mode Switches**—Determine the A Sweep triggering mode.

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 trigger signals having adequate amplitude and a repetition rate of about 20 Hz or faster. In the absence of a proper trigger signal, an autotrigger is generated, and the sweep free runs. The range of the A TRIGGER LEVEL control is restricted to the peak-to-peak range of the trigger signal. P-P AUTO is the usual trigger mode selection to obtain stable displays of TV Line information.

(20) **A and B SEC/DIV Variable Control and X0 Magnifier Switch**—Provides continuously variable, uncalibrated A Sweep speeds to at least 2.5 times the calibrated setting. It extends the slowest sweep speed to at least 1.25 s per division.

To expand the crt display by a factor of 10, pull out the X10 Magnifier control (SEC/DIV Variable control knob). The display portion of the sweep will be 10 times faster than the A and B SEC/DIV switch settings. This allows a maximum sweep speed of 5 ns per division. Push in the SEC/DIV Variable knob to regain the X1 (normal) sweep speed.

(21) **POSITION Control**—Horizontally positions the A Sweep display, B Sweep display, and X-axis in X-Y mode.

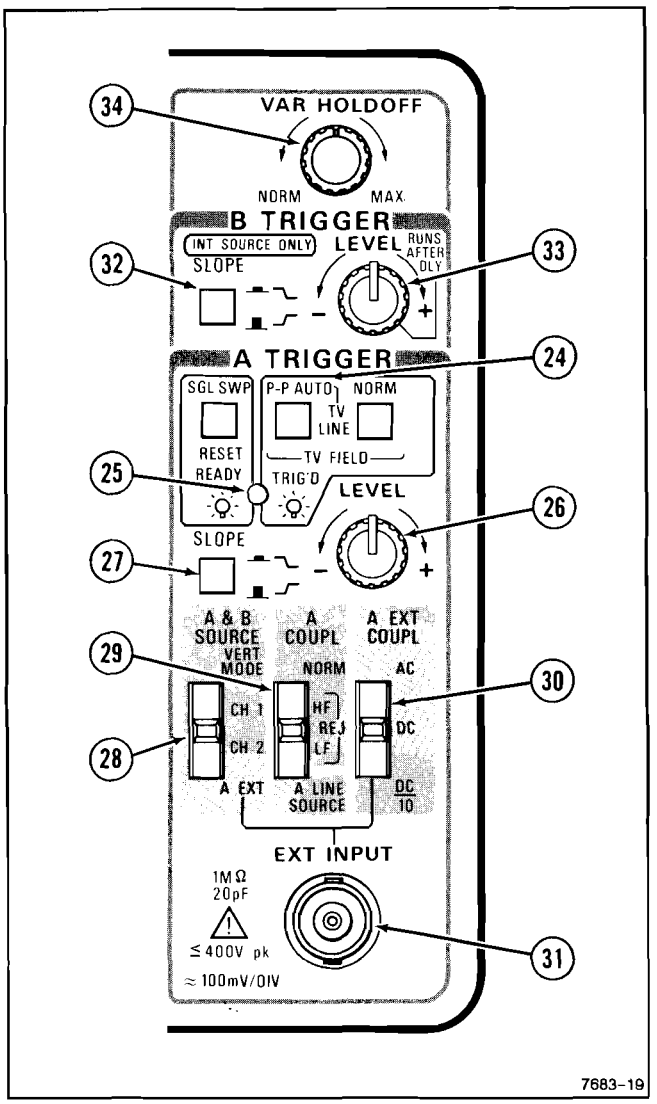


Figure 2-6. Trigger controls, connector, and indicator.

TV FIELD—Permits stable triggering on a television field (vertical sync) signal when the P-P AUTO and the NORM Trigger buttons are pressed in together. In the absence of an adequate trigger signal, the sweep free-runs. The instrument otherwise behaves as in P-P AUTO.

SGL SWP—Arms the A Trigger circuit for a single-sweep display. Triggering requirements are the same as in NORM trigger mode, except only one sweep is displayed for each trigger signal. After the completion of a triggered sweep, pressing in the SGL SWP button rearms the trigger circuitry to accept the next triggering event. 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).

(25) **RESET/READY Indicator**—A dual-function LED indicator. In P-P AUTO and NORM Trigger modes, the LED is turned on when triggering occurs. In SGL SWP Trigger mode, the LED turns on when the A Trigger circuit is armed, awaiting a triggering event, and turns off again after the single sweep event occurs.

(26) **A TRIGGER LEVEL Control**—Selects the voltage level on the A Trigger signal that produces triggering.

(27) **A TRIGGER SLOPE Switch**—Selects either the positive slope (button out) or negative slope (button in) of the trigger signal to start the A Sweep.

(28) **A & B SOURCE Switch**—Selects the source of the internal trigger signal for both the A and the B Trigger Generator circuits. Also selects internal trigger as the A Trigger source.

VERT MODE—Trigger signal is obtained alternately from the Channel 1 and Channel 2 input signals in ALT Vertical MODE. In the CHOP or ADD Vertical MODE the trigger signal is the sum of the Channel 1 and Channel 2 input signals. See Table 2-1 for VERT MODE trigger source.

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

CH 2—The signal applied to the CH 2 OR Y input connector is the source of the trigger signal. The polarity CH 2 Trigger signal may be inverted by the Channel 2 INVERT switch so the displayed slope agrees with the Trigger SLOPE switch.

A EXT—Signals applied to the EXT INPUT connector are routed to the A Trigger circuit.

(29) **A COUPL Switch**—Selects the method of coupling the input trigger signal to the A Trigger circuit.

NORM—All frequency components of the trigger signals are coupled to the A Trigger circuit.

HF REJ—Attenuates the high-frequency triggering signal components above 40 kHz of the trigger signal.

Table 2-1
Vertical 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 X 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.

LF REJ—Attenuates low-frequency triggering signal components below 40 kHz of the trigger signal.

A LINE SOURCE—Routes a sample of the ac power source waveform to the A Trigger circuit.

(30) **A EXT COUPL Switch**—Selects the method of coupling the external signal applied to the EXT INPUT connector to the A Trigger circuit.

AC—Input signal is capacitively coupled, and blocks the dc component of the signal.

DC—Couples dc and all frequency components of the external trigger signal.

DC/10—Attenuates the external signal by a factor of 10. Couples dc and all frequency components of the external trigger signal.

(31) **EXT INPUT Connector**—Provides for connection of external signals to the A Trigger circuit.

(32) **B TRIGGER SLOPE Switch**—Selects either the positive slope (button out) or the negative slope (button in) of the B Trigger signal (internal source only) that starts the B sweep.

(33) **B TRIGGER LEVEL Control**—Selects the amplitude point on the B Trigger signal where triggering occurs in triggerable after delay mode. The fully clockwise position of the B TRIGGER LEVEL Control selects the runs after delay mode of operation for the B Trigger circuitry. Out of the cw position, B Sweep is triggerable after the delay time.

(34) **VAR HOLDOFF Control**—Varies the holdoff time over a 10 to 1 range. Variable Holdoff starts at the end of the A Sweep. This control improves the ability to trigger on aperiodic signals (such as complex digital waveforms).

REAR PANEL

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

(35) **EXT Z-AXIS Connector**—Provides a means of connecting external signals to the Z-Axis amplifier to intensity modulate the crt. Applied signals do not affect display waveshape. Signals with fast rise times and fall times provide the best 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.

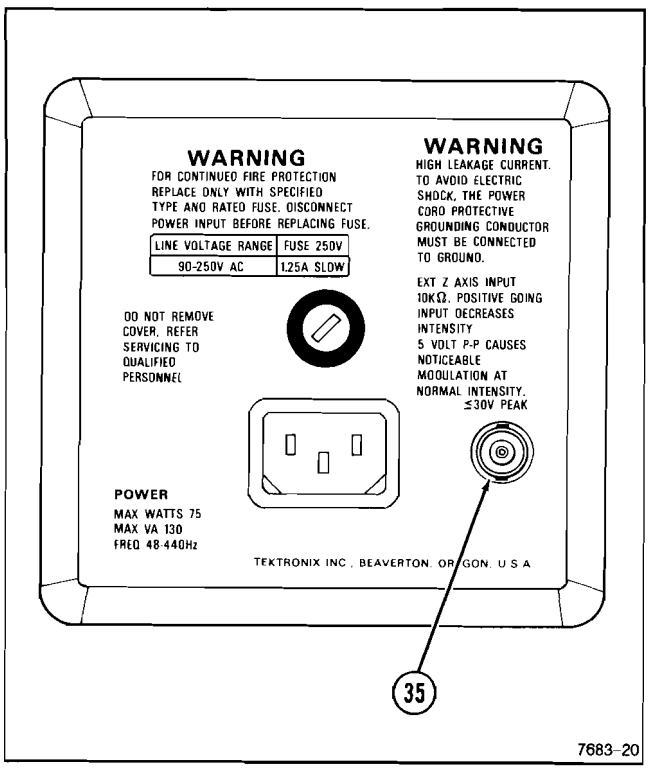


Figure 2-7. Rear-panel connector.

OPERATING CONSIDERATIONS

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.

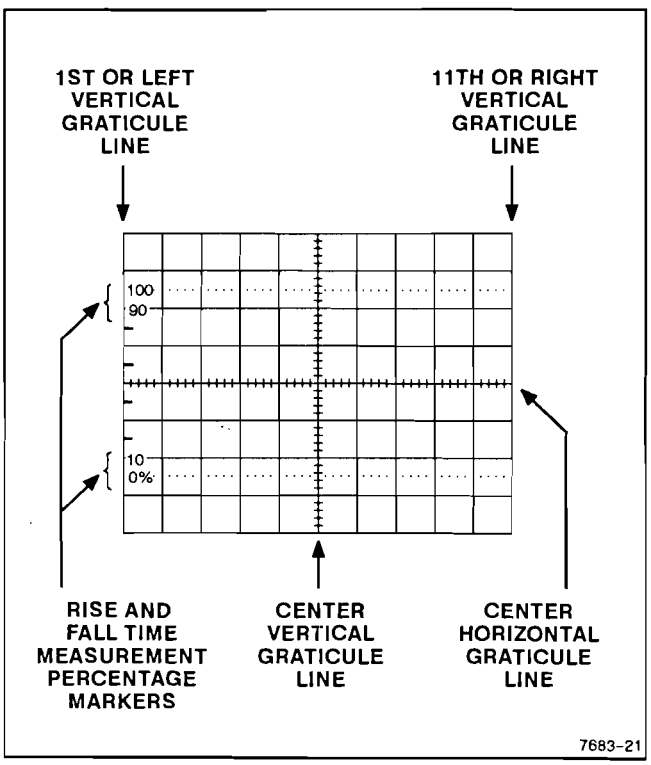


Figure 2-8. Graticule measurement markings.

GROUNDING

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

SIGNAL CONNECTIONS

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

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

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 CHECKS AND ADJUSTMENTS

INTRODUCTION

To verify the operation and accuracy of this instrument before making measurements, perform the following check and adjustment procedures. Adjustments beyond the scope of Operator's Adjustments are in the Adjustment Procedure Section 6 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 (button out). Then plug the power cord into the power-source outlet.

BASELINE TRACE

First, obtain a baseline trace using the following procedure.

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

Display

A and B INTENSITY	Fully counter-clockwise
FOCUS	Midrange

Vertical (Both Channels)

POSITION	Midrange
A/B SWP SEP	Midrange
MODE	CH 1
BW LIMIT	Off (button out)
VOLTS/DIV	10 mV
VOLTS/DIV Variable	CAL detent
INVERT	Off (button out)
Input Coupling	AC

Horizontal

POSITION	Midrange
MODE	A
A and B SEC/DIV	0.5 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise

B TRIGGER

SLOPE	Positive (button out)
LEVEL	RUNS AFTER DLY (fully clockwise)

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	AC

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

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

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

TRACE ROTATION

Normally, the resulting trace will be parallel to the center horizontal graticule line, and the Trace Rotation adjustment would 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 a small, flat-bladed screwdriver to adjust the TRACE ROTATION control and align the trace with the center horizontal graticule line.

PROBE COMPENSATION

Misadjustment of probe compensation is one of the 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. Connect the Channel 1 probe to the CAL output connector.

4. Use the the Channel 1 POSITION control to vertically center the the 5-division display. Adjust the A TRIGGER LEVEL control to obtain a stable display.

5. Check the waveform display 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 probe for details of compensation adjustment.

6. Disconnect the Channel 1 probe from the CAL connector.

7. Connect the Channel 2 probe to the CAL connector.

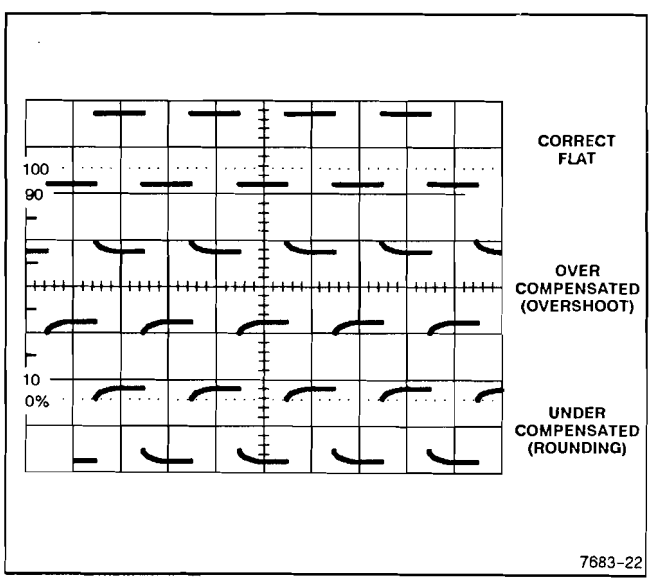


Figure 2-9. Probe compensation.

8. Set the Vertical MODE to CH 2 and vertically center the 5-division display using the Channel 2 POSITION control.

9. Check the waveform display 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 probe for details of compensation adjustment.

VERTICAL DEFLECTION CHECK

The CAL signal can be used as a convenient way of checking the instrument vertical deflection system with the following checks:

1. Preset the 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 0.1 V 10X PROBE setting and set both Input Coupling switches to DC.

4. Select CH 1 Vertical MODE and connect the Channel 1 probe to the CAL connector.

5. Using the 1 kHz CAL squarewave signal as the input, obtain a 5-division display of the signal.

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

7. Check for a vertical display amplitude of approximately 5 divisions.

8. Select CH 2 Vertical MODE and connect the Channel 2 probe to the CAL connector.

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

10. Disconnect the probes from the instrument.

BASIC APPLICATIONS

INTRODUCTION

The information in this part is designed to enhance operator understanding and to assist in developing efficient techniques for making specific measurements. Recommended methods for making basic measurements with your instrument are described in the procedures contained in this section.

When a procedure first calls for presetting instrument controls and obtaining a baseline trace, refer to the Operator's Checks and Adjustments part in this section and perform steps 1 through 4 under Baseline Trace.

INDEX TO BASIC APPLICATION PROCEDURES

VOLTAGE MEASUREMENTS

Peak-to-Peak Voltage

To make a peak-to-peak voltage measurement, use the following procedure:

NOTE

This procedure may also be used to make voltage measurements between any two points on the waveform.

1. Preset instrument controls and obtain a baseline trace.
2. Apply the ac signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.
3. Set the appropriate VOLTS/DIV switch to display about five divisions of the waveform, ensuring that the VOLTS/DIV Variable control is in the CAL detent.
4. Adjust the A TRIGGER LEVEL control to obtain a stable display.
5. Set the A SEC/DIV switch to a position that displays several cycles of the waveform.
6. Vertically position the display so that the negative peak of the waveform coincides with one of the horizontal graticule lines (see Figure 2-10, Point A).
7. Horizontally position the display so that one of the positive peaks coincides with the center vertical graticule line (see Figure 2-10, Point B).
8. Measure the vertical deflection from peak to peak (see Figure 2-10, Point A to Point B).

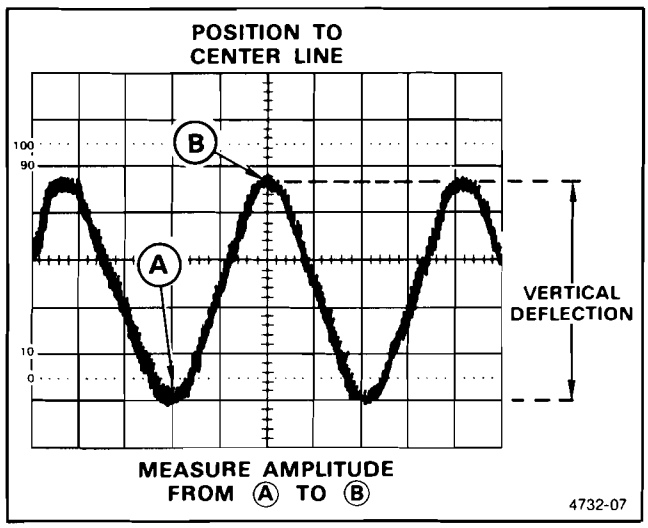


Figure 2-10. Peak-to-peak waveform voltage.

NOTE

If the amplitude measurement is critical or if the trace is thick (as a result of hum or noise on the signal), a more accurate value can be obtained by measuring from the top of a peak to the top of a valley. This will eliminate trace thickness from the measurement.

9. Calculate the peak-to-peak voltage, using the following formula:

$$\text{Volts (p-p)} = \begin{matrix}\text{vertical}\\ \text{deflection}\\ \text{(divisions)}\end{matrix} \times \begin{matrix}\text{VOLTS/DIV}\\ \text{switch setting}\\ \text{indicated by 1X}\\ \text{(or 10X PROBE when}\\ \text{10X probe is used)}\end{matrix}$$

EXAMPLE: The measured peak-to-peak vertical deflection is 4.6 divisions (see Figure 2-10) using a 10X attenuator probe with the VOLTS/DIV switch set to 5 V (at 10X PROBE setting).

Substituting the given values:

Volts (p-p) = 4.6 div X 5 V/div = 23 V.

Instantaneous Voltage

To measure instantaneous voltage level at a given point on a waveform, referred to ground, use the following procedure:

1. Preset instrument controls and obtain a baseline trace.

2. Apply the signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.

3. Verify that the VOLTS/DIV Variable control is in the CAL detent and set the Input Coupling switch to GND.

4. Vertically position the baseline trace to the center horizontal graticule line. This establishes the ground reference location.

NOTE

If measurements are to be made relative to a voltage level other than ground, set the Input Coupling switch to DC and apply the reference voltage to the input connector. Then position the trace to the reference (horizontal graticule) line.

5. Set the Input Coupling switch to DC. Points on the waveform above the ground reference location are positive. Those points below are negative.

NOTE

When using Channel 2, ensure that the Invert mode is not selected (INVERT button out).

6. If necessary, repeat Step 4 using a different reference line which allows the waveform in Step 5 to be displayed on screen.

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

8. Set the A SEC/DIV switch to a position that displays several cycles of the signal.

9. Measure the divisions of vertical deflection between the ground reference line and the point on the waveform at which the level is to be determined (see Figure 2-11).

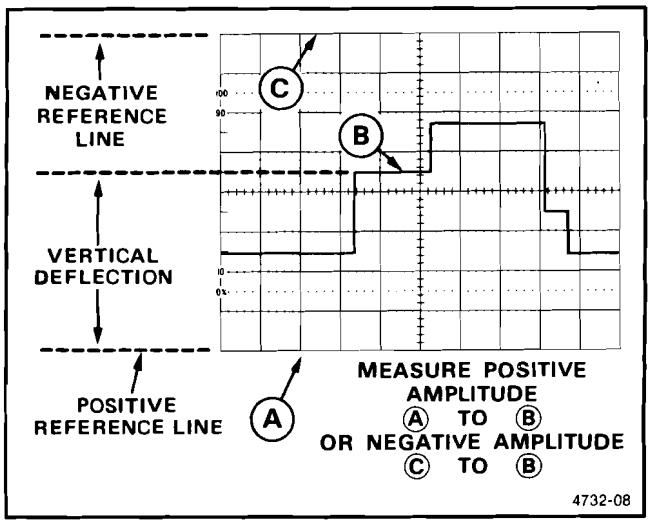


Figure 2-11. Instantaneous voltage measurement.

10. Calculate the instantaneous voltage, using the following formula:

$$\text{Instantaneous Voltage} = \text{vertical deflection (divisions)} \times \text{polarity (+ or -)} \times \text{VOLTS/DIV switch setting indicated by 1X (or 10X PROBE when 10X probe is used)}$$

EXAMPLE: The measured vertical deflection from the reference line is 4.5 divisions (see Figure 2-11), the waveform point is above the reference line, a 10X attenuator probe is being used, and the VOLTS/DIV switch is set to 2 V (at 10X PROBE setting).

Substituting the given values:

Instantaneous Voltage = 4.5 div X (+ 1) X 2 V/div = 9.0 V.

Algebraic Addition

With the Vertical MODE switches set to BOTH and ADD, the waveform displayed is the algebraic sum of the signals applied to the Channel 1 and Channel 2 inputs (CH 1 + CH 2). If the Channel 2 INVERT mode is selected (INVERT button in), the waveform displayed is the difference between the signals applied to the Channel 1 and Channel 2 inputs (CH 1 − CH 2). When both vertical channels are set to the same voltage settings, the deflection factor is equal to that indicated by either VOLTS/DIV switch.

The following general precautions should be observed when using the ADD mode.

a. Do not exceed the input voltage rating of the oscilloscope.

b. Do not apply signals that exceed the equivalent of about eight times the VOLTS/DIV switch settings, since large voltages may distort the display. For example, with a VOLTS/DIV switch setting of 0.5 V, the voltage applied to that channel should not exceed about 4 volts.

c. Use Channel 1 and Channel 2 POSITION control settings which most nearly position the signal on each channel to midscreen, when viewed in either CH 1 or CH 2 Vertical MODE. This ensures the greatest dynamic range for ADD mode operation.

d. To attain similar response from each channel, set both the Channel 1 and Channel 2 Input Coupling switches to the same position.

Common-Mode Rejection

The following procedure shows how to eliminate unwanted ac input-power frequency components. Similar methods could be used either to eliminate other unwanted frequency components or to provide a dc offset.

1. Preset instrument controls and obtain a baseline trace.

2. Apply the signal containing the unwanted line-frequency components to the CH 1 input connector.

3. Apply a line-frequency signal to the CH 2 input connector. To maximize cancellation, the signal applied to Channel 2 must be in phase with the unwanted line-frequency component on the Channel 1 input.

4. Select BOTH and CHOP Vertical MODE and set both VOLTS/DIV switches to produce displays of approximately 4 or 5 divisions in amplitude.

5. Adjust the CH 2 VOLTS/DIV switch and CH 2 VOLTS/DIV Variable controls so that the Channel 2 display signal is approximately the same amplitude as the undesired portion of the Channel 1 display (see Figure 2-12A).

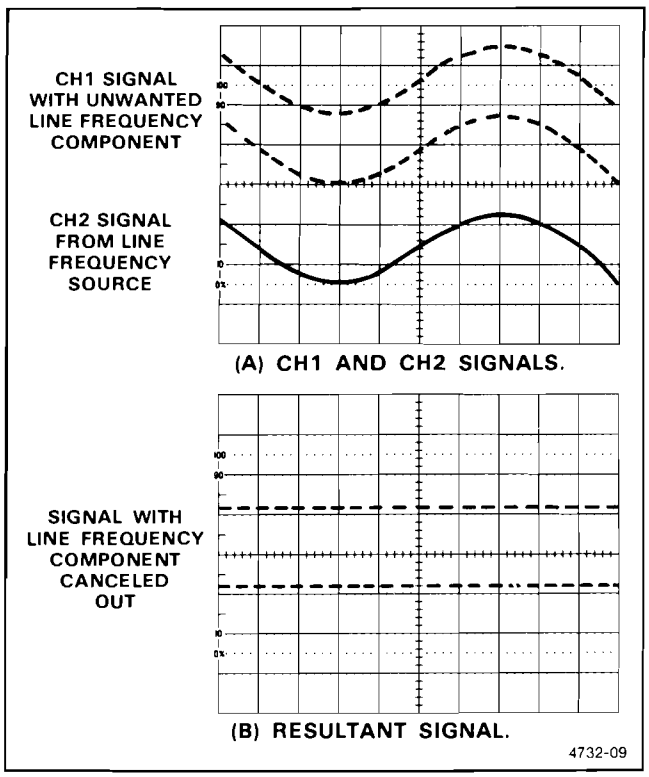


Figure 2-12. Common-mode rejection.

6. Select ADD Vertical MODE and press the INVERT button to invert the Channel 2 display. Slightly readjust the CH 2 VOLTS/DIV Variable control for maximum cancellation of the undesired signal component (see Figure 2-12B).

Amplitude Comparison (Ratio)

In some applications it may be necessary to establish a set of deflection factors other than those indicated by the VOLTS/DIV switch settings. This is useful for comparing unknown signals to a reference signal of known amplitude. To accomplish this, a reference signal of known amplitude is first set to an exact number of vertical divisions by adjusting the VOLTS/DIV switch and the Variable control. Unknown signals can then be quickly and accurately compared with the reference signal without disturbing the setting of the VOLTS/DIV Variable control. This procedure is as follows:

1. Preset instrument controls and obtain a baseline trace.

2. Apply the reference signal to either vertical channel input and set the Vertical MODE switch to display the channel used.

3. Set the amplitude of the reference signal to five vertical divisions by adjusting the VOLTS/DIV switch and Variable control.

4. Disconnect the reference signal and apply the unknown signal to be measured to the same channel input. Adjust the vertical position of the waveform so that its bottom edge just touches the 0% line on the screen.

5. Horizontally position the waveform so that its topmost features cross the center vertical graticule line (see Figure 2-13).

6. Read the percent ratio directly from the graduations of the center graticule line, referring to the 0% and 100% percentage marks on the left edge of the graticule (1 minor division equals 4% for a 5-division display).

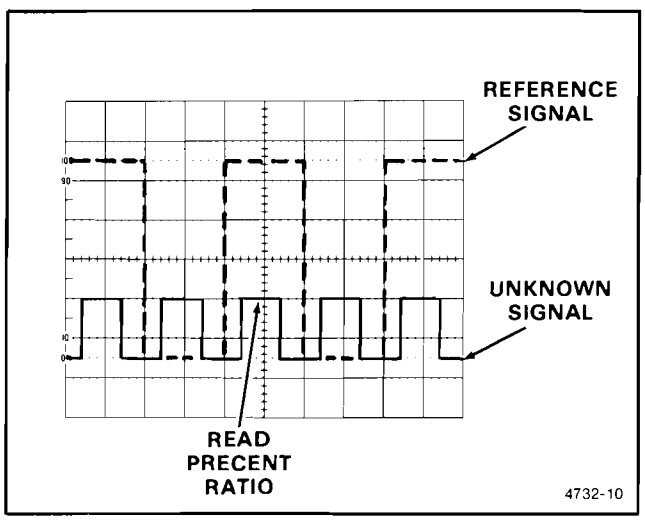


Figure 2-13. Voltage ratios.

NONDELAYED TIME MEASUREMENTS

Time Duration

To measure time between two points on a waveform, use the following procedure.

1. Preset instrument controls and obtain a baseline trace.

2. Apply the signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.

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

4. Set the A SEC/DIV switch to display one complete period of the waveform. Ensure that the SEC/DIV Variable control is in the CAL detent.

5. Position the display to place the time-measurement points on the center horizontal graticule line (see Figure 2-14).

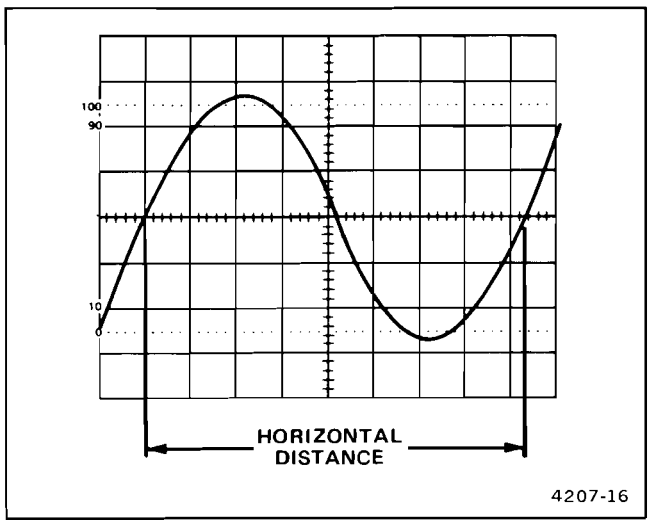


Figure 2-14. Time duration.

6. Measure the horizontal distance between the time-measurement points.

7. Calculate time duration using the following formula:

$$\text{Time Duration} = \frac{\text{horizontal distance (division)} \times \text{A SEC/DIV switch setting}}{\text{magnification factor}}$$

EXAMPLE: The distance between the time measurement points is 8.3 divisions (see Figure 2-15), and the A SEC/DIV switch is set to 2 ms per division. The X10 Magnifier is off (knob in).

Substituting the given values:

$$\text{Time Duration} = \frac{8.3 \text{ div} \times 2 \text{ ms/div}}{1} = 16.6 \text{ ms}$$

Frequency

The frequency of a recurrent signal can be determined from its time-duration measurement as follows:

1. Measure the time duration of one waveform cycle using the preceding Time Duration measurement procedure.

2. Calculate the reciprocal of the time-duration value to determine the frequency of the waveform.

EXAMPLE: The signal in Figure 2-15 has a time duration of 16.6 ms.

Calculating the reciprocal of time duration:

$$\text{Frequency} = \frac{1}{\text{time duration}} = \frac{1}{16.6 \text{ ms}} = 60 \text{ Hz}$$

Rise Time

Rise-time measurements use the same methods as time duration, except that the measurements are made between the 10% and 90% points of the low-to-high transition of the selected waveform (see Figure 2-15). Fall time is measured between the 90% and 10% points of the high-to-low transition of the waveform.

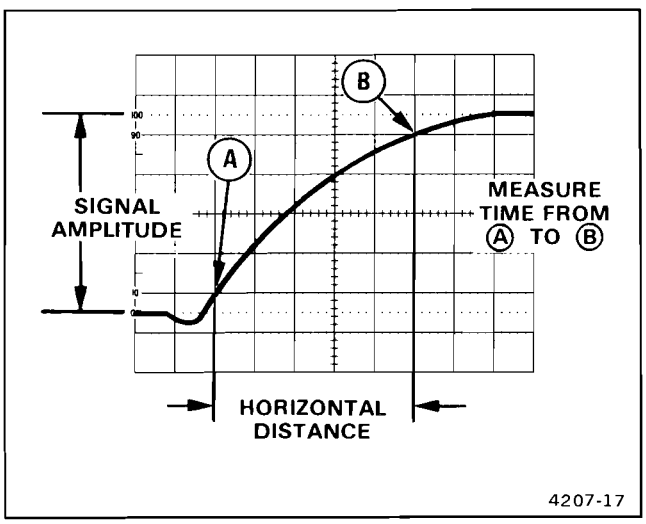


Figure 2-15. Rise time.

1. Preset instrument controls and obtain a baseline trace. Ensure that the BW LIMIT is off (button out).

2. Apply a signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.

3. Set the appropriate VOLTS/DIV switch and variable control for an exact 5-division display.

4. Vertically position the trace so that the bottom of the waveform touches the 0% graticule line and the top of the waveform touches the 100% graticule line.

5. Horizontally position the display so the 10% point on the waveform intersects the second vertical graticule line.

6. Measure the horizontal distance between the 10% and 90% points (between Points A and B of Figure 2-16) and calculate the time duration using the following formula:

$$\text{Rise Time} = \frac{\text{horizontal distance (divisions)} \times \text{A SEC/DIV switch setting}}{\text{magnification factor}}$$

Example: The horizontal distance between the 10% and 90% points is 5 divisions, and the A SEC/DIV switch is set to 1 μs per division. A magnification factor of 1 is used.

Substituting the given values in the formula:

$$\text{Rise Time} = \frac{5 \text{ div} \times 1 \text{ μs/div}}{1} = 5 \text{ μs}$$

Time Difference Between Pulses on Time-Related Signals

The calibrated sweep speed and dual-trace features of this instrument allow measurement of the time difference between two separate time- related events. To measure time difference, use the following procedure:

1. Preset instrument controls and obtain a baseline trace, then set the A & B SOURCE switch to CH 1.

2. Set both Input Coupling switches to the same position, depending on the type of input coupling desired.

3. Using either probes or cables with equal time delays, connect a known reference signal to the Channel 1 input and the comparison signal to the Channel 2 input.

4. Set both VOLTS/DIV switches for 4- or 5-division displays.

5. Select BOTH Vertical MODE; then select either ALT or CHOP, depending on the frequency of input signals.

6. If the two signals are of opposite polarity, press INVERT button to invert the Channel 2 display (signals may be of opposite polarity due to 180° phase difference).

7. Adjust the A TRIGGER LEVEL control for a stable display.

8. Set the A SEC/DIV switch to a sweep speed which provides three or more divisions of horizontal separation between the reference points on the two displays. Center each of the displays vertically (see Figure 2-16)

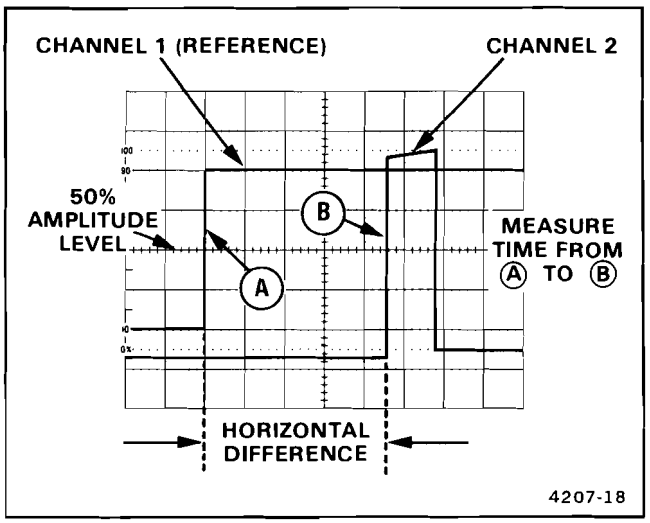


Figure 2-16. Time difference between pulses on time-related signals.

9. Measure the horizontal difference between the two signal reference points and calculate the time difference using the following formula:

$$\text{Time Difference} = \frac{\text{A SEC/DIV switch setting} \times \text{horizontal difference (divisions)}}{\text{magnification factor}}$$

EXAMPLE: The A SEC/DIV switch is set to 50 μs per division, the X10 Magnifier is on (button out) and the horizontal difference between waveform measurement points is 4.5 divisions.

Substituting the given values in the formula:

$$\text{Time Difference} = \frac{50 \text{ μs/div} \times 4.5 \text{ div}}{10} = 22.5 \text{ μs}$$

Phase Difference

In a similar manner to Time Difference Between Two Time-Related Pulses, phase comparison between two signals of the same frequency can be made using the dual-trace feature of the instrument. This method of phase difference measurement can be used up to the

frequency limit of the vertical deflection system. To make a phase comparison, use the following procedure:

1. Preset instrument controls and obtain a baseline trace, then set the A & B SOURCE switch to CH 1.

2. Set both Input Coupling switches to the same position, depending on the type of input coupling desired.

3. Using either probes or cables with equal time delays, connect a known reference signal to the Channel 1 input and the unknown signal to the Channel 2 input.

4. Select BOTH Vertical MODE; then select either ALT or CHOP, depending on the frequency of input signals. The reference signal should precede the comparison signal in time.

5. If the two signals are of opposite polarity, press INVERT button to invert the Channel 2 display.

6. Set both VOLTS/DIV switches and both Variable controls so the displays are equal in amplitude.

7. Adjust the A TRIGGER LEVEL control for a stable display.

8. Set the A SEC/DIV switch to a sweep speed which displays about one full cycle of the reference waveform.

9. Position the displays and adjust the SEC/DIV Variable control so that one reference-signal cycle occupies exactly 8 horizontal divisions at the 50% rise-time points (see Figure 2-18). Each division of the graticule now represents 45° of the cycle (360° ÷ 8 divisions), and the horizontal calibration can be stated as 45° per division.

10. Measure the horizontal difference between corresponding points on the waveforms at a convenient horizontal graticule line and calculate the phase difference using the following formula:

$$\text{Phase Difference} = \text{horizontal difference (divisions)} \times \text{horizontal calibration (deg/div)}$$

Example: The horizontal difference is 0.6 division with a graticule calibration of 45° per division, as shown in Figure 2-17.

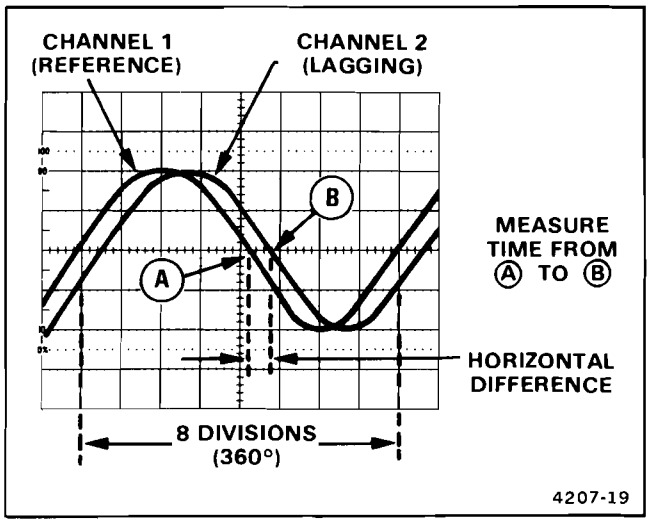


Figure 2-17. Phase difference.

Substituting the given values into the phase difference formula:

Phase difference = 0.6 div x 45°/div = 27°

More accurate phase measurements can be made by using the X10 Magnifier function to increase the sweep speed without changing the SEC/DIV Variable control setting.

EXAMPLE: If the sweep speed were increased 10 times with the magnifier (X10 Magnifier knob out), the magnified horizontal calibration would be 45°/division divided by 10 (or 4.5°/division). Figure 2-18 shows the same signals illustrated in Figure 2-17, but magnifying the displays results in a horizontal difference of 6 divisions between the two signals.

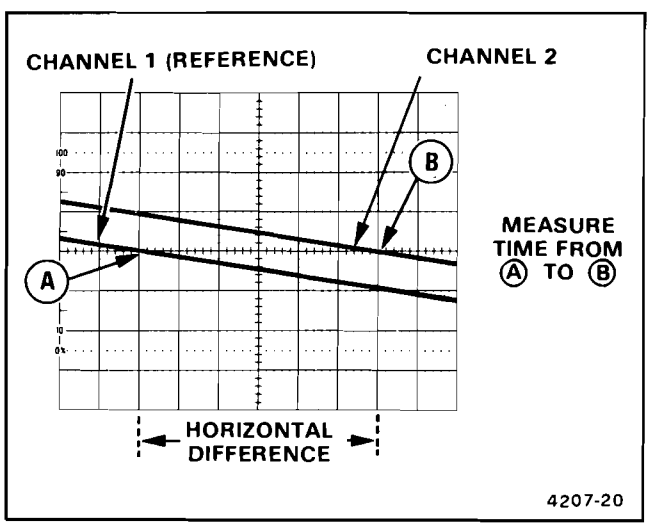


Figure 2-18. High-resolution phase difference.

Substituting the given values in the phase difference formula:

Phase difference = 6 div x 4.5°/div = 27°

TELEVISION DISPLAYS

TV Line Signal

The following procedure is used to display a TV Line signal.

1. Preset instrument controls and set A TRIGGER Mode to P-P AUTO/TV LINE.
2. Apply the TV signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.
3. Set the appropriate VOLTS/DIV switch to display 1 division or more of composite video signal.
4. Set the A SEC/DIV switch to 10 μs.
5. For positive-going TV signal sync pulses, set the A TRIGGER SLOPE switch to positive (button out); for negative-going TV signal sync pulses, set the A TRIGGER SLOPE switch to negative (button in).

NOTE

To examine a TV Line signal in more detail, either the X10 Magnifier or the Delayed-Sweep Magnification feature may be used.

TV Field Signal

The television feature of this instrument can also be used to display TV Field signals.

1. Preset instrument controls and obtain a baseline trace.
2. Select TV FIELD A TRIGGER mode (push both P-P AUTO and NORM buttons in) and set the A SEC/DIV switch to 2 ms.
3. To display a TV field, connect the TV signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.
4. Set the appropriate VOLTS/DIV switch to display 1 division or more of composite video signal.
5. For positive-going TV signal sync pulses, set the A TRIGGER SLOPE switch to positive (button out); for negative-going TV signal sync pulses, set the A TRIGGER SLOPE switch to negative (button in).
6. To change the TV field that is displayed, momentarily interrupt the trigger signal by setting the Input Coupling switch to GND and then back to DC or AC until the desired field is displayed.

NOTE

To examine a TV Field signal in more detail, either the X10 Magnifier or the Delayed-Sweep Magnification feature may be used.

7. To display a selected horizontal line, first trigger the sweep on a vertical (field) sync pulse, then use the Magnified Sweep Runs After Delay procedure in this part (steps 5 and 6) to magnify the selected horizontal line for a closer examination. This procedure is useful for examining Vertical Interval Test Signals (VITS).
8. To display either Field 1 or Field 2 individually, connect the TV signal to both CH 1 and CH 2 input connectors and select BOTH and ALT Vertical MODE.
9. Set the A SEC/DIV switch to 0.5 ms or faster sweep speed (displays less than one full field). This will synchronize Channel 1 display to one field and Channel 2 to the other field.

DELAYED-SWEEP MAGNIFICATION

The delayed-sweep feature of this instrument can be used to provide higher apparent magnification than is provided by the X10 Magnifier switch. Apparent magnification occurs as a result of displaying a selected portion of the A trace at a faster sweep speed (B Sweep speed). The A SEC/DIV switch setting determines how often the B trace will be displayed. Since the B Sweep can occur only once for each A Sweep, the A Sweep time duration determines the time interval between succeeding B Sweeps.

The intensified zone is an indication of both the location and length of the B Sweep interval within the A Sweep interval. Positioning of the intensified zone (i.e., setting the amount of time between start of the A Sweep and start of the B Sweep) is accomplished with the B DELAY TIME POSITION control. With either ALT or B Horizontal MODE selected and B TRIGGER LEVEL control set fully

clockwise (RUNS AFTER DLY), the B DELAY TIME POSITION control provides continuously variable positioning of the start of the B Sweep. The range of this control is sufficient to place the B Sweep interval at most any location within the A Sweep interval. When ALT Horizontal MODE is selected, the B SEC/DIV switch setting determines the B Sweep speed and concurrently sets the length of the intensified zone on the A trace.

Using delayed-sweep magnification may produce a display with some slight horizontal movement (pulse jitter). Pulse jitter includes not only the inherent uncertainty of triggering the delayed sweep at exactly the same trigger point each time, but also jitter that may be present in the input signal. If pulse jitter needs to be measured, use the Pulse Jitter Time Measurement procedure which follows the discussion of Magnified Sweep Runs After Delay.

Magnified Sweep Runs After Delay

The following procedure explains how to operate the B Sweep in a nontriggered mode and to determine the resulting apparent magnification factor.

1. Preset instrument controls and obtain a baseline trace.

2. Apply the signal to either vertical channel input connector and set the Vertical MODE switch to display the channel used.

3. Set the appropriate VOLTS/DIV switch to produce a display of approximately 2 or 3 divisions in amplitude and center the display.

4. Set the A SEC/DIV switch to a sweep speed which displays at least one complete waveform cycle.

5. Select ALT Horizontal MODE. Adjust both the appropriate channel POSITION control and the A/B SWP SEP control to display the A trace above the B trace.

6. Adjust the B DELAY TIME POSITION control to position the start of the intensified zone to the portion of the display to be magnified (see Figure 2-19).

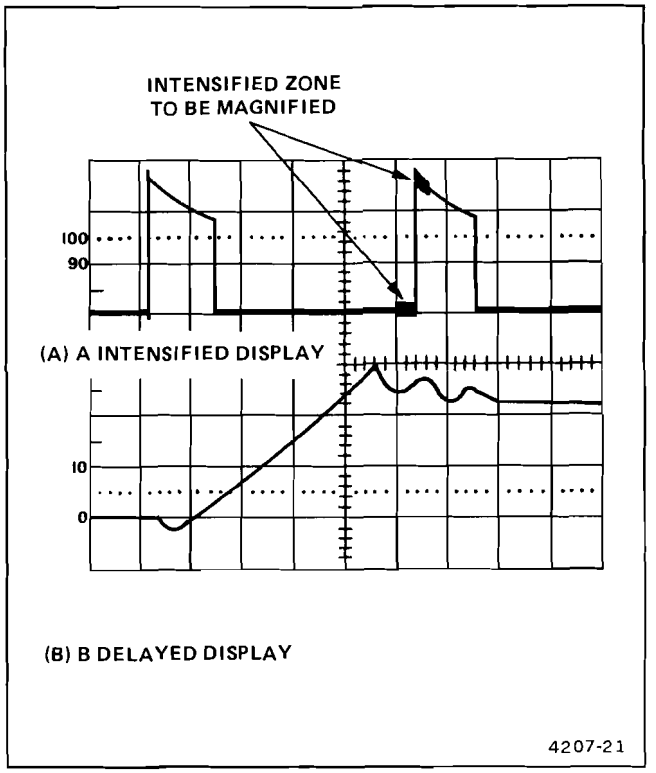


Figure 2-19. Delayed-sweep magnification.

7. Set the B SEC/DIV switch to a setting which intensifies the full portion of the A trace to be magnified. The intensified zone will be displayed as the B trace (see Figure 2-19). The B Horizontal MODE may also be used to magnify the intensified portion of the A Sweep.

8. The apparent sweep magnification can be calculated from the following formula:

$$\text{Apparent Delayed Sweep Magnification} = \frac{\text{A SEC/DIV switch setting}}{\text{B SEC/DIV switch setting}}$$

EXAMPLE: Determine the apparent magnification of a display with an A SEC/DIV switch setting of 0.1 ms per division and a B SEC/DIV switch setting of 1 μs per division.

Substituting the given values:

$$\text{Apparent Magnification} = \frac{1 \times 10^{-4}\ \text{s}}{1 \times 10^{-6}\ \text{s}} = 10^2 = 100$$

Pulse Jitter Time Measurement

To measure pulse jitter time:

1. Perform steps 1 through 7 of the preceding Magnified Sweep Runs After Delay procedure.

2. Referring to Figure 2-20, measure the difference between Point C and Point D in divisions and calculate the pulse jitter time using the following formula:

Pulse Jitter Time	=	Horizontal difference (divisions)	×	B SEC/DIV switch setting

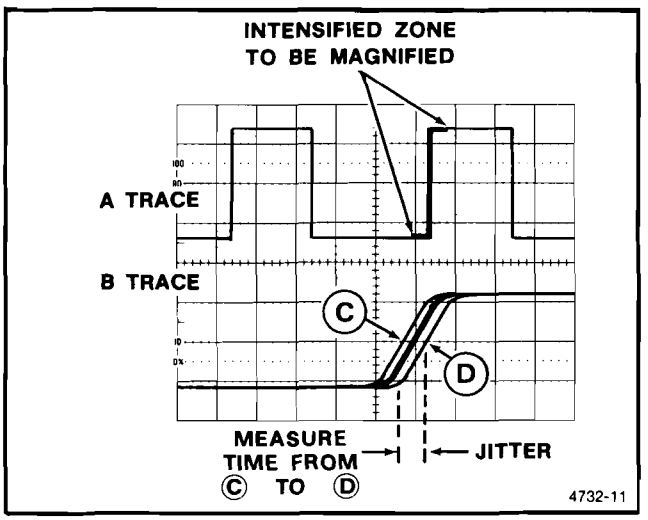


Figure 2-20. Pulse jitter.

Triggered Magnified Sweep

The following procedure explains how to operate the B Sweep in a triggered mode and to determine the resulting apparent magnification factor. Operating the B Sweep in a triggered mode provides a more stable display, since the delayed display is triggered at the same point each time.

1. Perform steps 1 through 7 of the preceding Magnified Sweep Runs After Delay procedure.

2. Adjust the B TRIGGER LEVEL control so the intensified zone on the A trace is stable.

NOTE

The intensified zone seen in the ALT Horizontal MODE display will move from trigger point to trigger point as the B DELAY TIME POSITION control is rotated.

3. The apparent magnification factor can be calculated from the formula shown in step 8 of the Magnified Sweep Runs After Delay procedure.

DELAYED-SWEEP TIME MEASUREMENTS

Operating this instrument with the Horizontal MODE set to either ALT or B will permit time measurements to be made with a greater degree of accuracy than attained with Horizontal MODE set to A. The following procedures describe how these measurements are accomplished.

Time Difference on Single Waveform

To measure time between two points on a waveform, use the following procedure.

1. Preset instrument controls and obtain a baseline trace.

2. Apply the signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.

3. Set the appropriate VOLTS/DIV switch to produce a display of approximately 2 or 3 divisions in amplitude.

4. Set the A SEC/DIV switch to display the measurement points of interest on the waveform. Ensure that the SEC/DIV Variable control is in the CAL detent.

5. Select ALT Horizontal MODE and adjust both the appropriate vertical POSITION control and A/B SWP SEP control to display the A trace above the B trace (see Figure 2-21).

6. Set the B SEC/DIV switch to the fastest sweep speed that provides a usable (visible) intensified zone.

7. Adjust the B DELAY TIME POSITION control to move the intensified zone to the leading edge on the first point of interest (on the A trace); then fine adjust until the selected portion (on the B trace) is centered at any convenient vertical graticule line (see Figure 2-21).

8. Record the B DELAY POSITION dial setting.

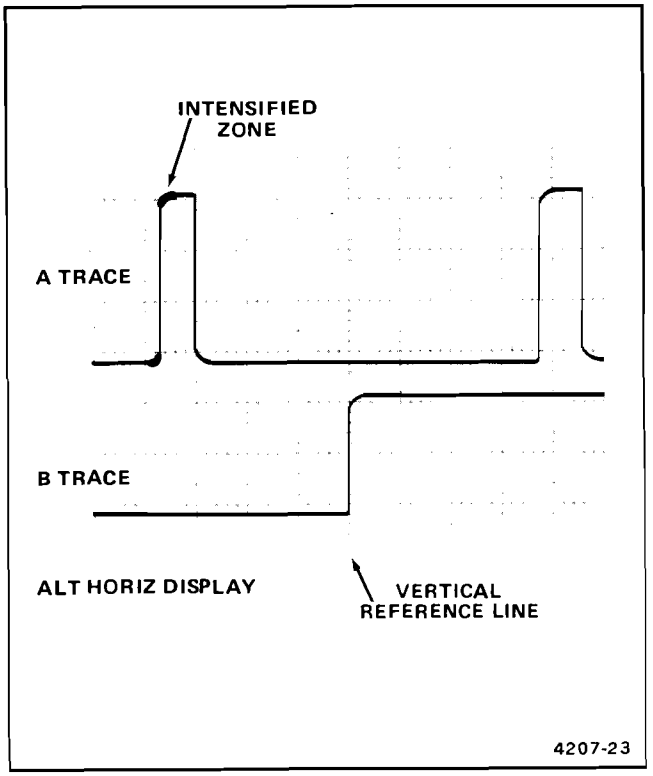


Figure 2-21. Time difference on single waveform.

9. Adjust the B DELAY POSITION control clockwise to move the intensified zone to the leading edge of the second point of interest (on the A trace); then fine adjust until the rising portion (on the B trace) is centered at the same convenient vertical graticule used in preceding step 7.

10. Record the B DELAY TIME POSITION control dial setting.

11. Calculate the time difference between repetitive pulses using the following formula.

$$\text{Time Difference (Duration)} = \left[\begin{array}{c}\text{second dial setting} - \text{first dial setting}\end{array}\right]\left[\begin{array}{c}\text{A SEC/DIV switch setting}\end{array}\right]$$

EXAMPLE: With the A SEC/DIV switch set to 0.02 ms per division, the first B DELAY TIME POSITION dial setting is 1.20 and the second B DELAY TIME POSITION dial setting is 9.53 (see Figure 2-22).

Substituting the given values in the time difference formula:

Time Difference = (9.53 - 1.20)(0.2 ms/div) = 1.666 ms

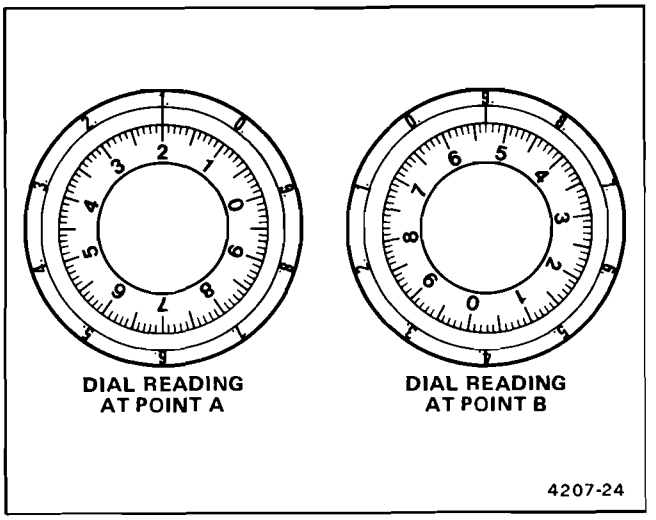


Figure 2-22. DELAY TIME POSITION control settings.

Rise Time

Rise-time measurements use the same methods as Time Difference on Single Waveform, except that the measurements are made between the 10% and 90% points of the low-to-high transition of of the selected waveform. Fall time is measured between the 90% and 10% points of the high-to-low transition of the waveform.

1. Preset instrument controls and obtain a baseline trace.

2. Apply a signal to either vertical-channel input connector and set the Vertical MODE switch to display the channel used.

3. Set the appropriate VOLTS/DIV switch and variable control for an exact 5-division display.

4. Vertically position the trace so that the bottom of the waveform touches the 0% graticule line and the top of the waveform touches the 100% graticule line.

5. Set the A SEC/DIV switch so one transition of interest is displayed. Ensure that the SEC/DIV Variable control is in the CAL detent.

6. Select ALT Horizontal MODE and adjust the B DELAY TIME POSITION control to intensify the transition of interest on A Sweep. Set the B SEC/DIV switch to spread the portion of the A display being measured as much as possible on the B Sweep.

7. Select the B Horizontal MODE. Adjust the B DELAY TIME POSITION control until the display intersects the 10% point at the center vertical graticule line (see Figure 2-23, Point A).

8. Record the B DELAY TIME POSITION control dial setting.

9. Adjust the B DELAY TIME POSITION control until the display intersects the 90% point at the center vertical graticule line (see Figure 2-23, Point B).

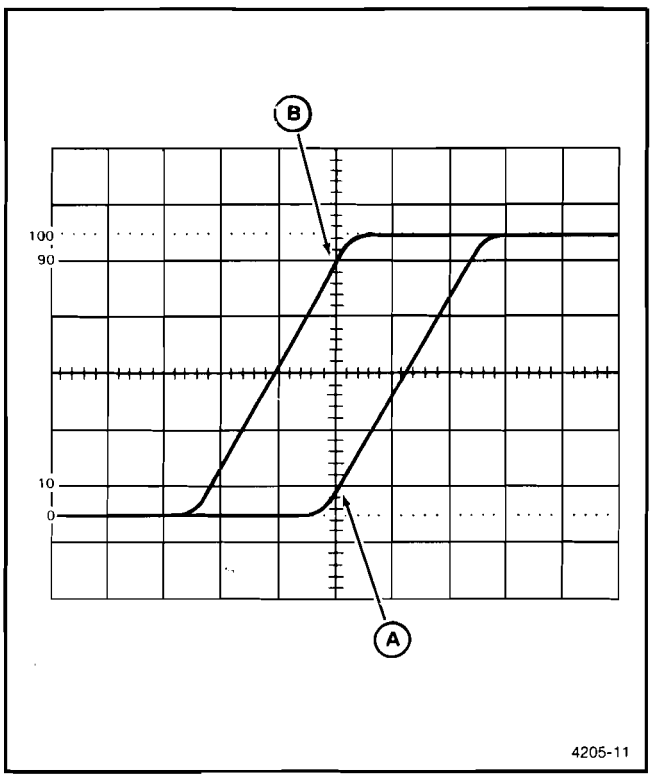


Figure 2-23. Rise time, differential time method.

10. Record the B DELAY TIME POSITION control dial setting.

11. Calculate rise time using the same formula listed in the Time Difference on Single Waveform measurement procedure.

    EXAMPLE: With the A SEC/DIV switch set to 1 μs per division, the first B DELAY TIME POSITION dial setting (Point A) is 2.50 and the second B DELAY TIME POSITION dial setting (Point B) is 7.50.

    Substituting the given values in the time difference formula:

    Rise Time = (7.50 - 2.50)(1 μs/div) = 5 μs

Time Difference Between Two Pulses on Two Time-Related Signals

1. Preset instrument controls and obtain a baseline trace. Set the A & B SOURCE switch to CH 1 and the Vertical MODE switches to BOTH and ALT.

2. Using probes or cables having equal time delays, apply the reference signal to the Channel 1 input and apply the comparison signal to the Channel 2 input.

3. Set the appropriate VOLTS/DIV switch to produce a display of approximately 2 or 3 divisions in amplitude.

4. Set the A SEC/DIV switch to display the measurement points of interest within the graticule area.

5. Select ALT Horizontal MODE and CH 1 Vertical MODE. Adjust both the Channel 1 POSITION control and the A/B SWP SEP control so that the A trace is displayed above the B trace.

6. Rotate the B DELAY TIME POSITION control to move the intensified zone to the appropriate edge of the reference signal (on the A trace); then fine adjust until the edge of the reference signal (on the B trace) is centered at any convenient vertical graticule line (see Figure 2-24, Part A).

7. Record the B DELAY TIME POSITION control dial setting.

8. Select CH 2 Vertical MODE and adjust both the Channel 2 POSITION control and the A/B SWP SEP control as necessary to display the A trace above the B trace.

9. Rotate the B DELAY TIME POSITION control to move the intensified zone to the appropriate edge of the comparison signal (on the A trace); then fine adjust until the edge of the comparison signal is at the same vertical reference point as used in preceding step 6 (see Figure 2-24, Part B). Do not change the setting of the Horizontal POSITION control.

10. Record the B DELAY TIME POSITION control dial setting.

11. Calculate the time difference between the reference signal (Channel 1) and comparison signal (Channel 2) as in the preceding Time Difference on Single Waveform measurement procedure.

    EXAMPLE: With the A SEC/DIV switch set to 50 μs per division, the dial reading for the reference pulse (Channel 1) is 2.60 and the dial reading for the comparison pulse (Channel 2) is 7.10.

    Substituting the given values into the time-difference formula:

    Time Difference = (7.10 – 2.60)(50 μs/div) = 225 μs

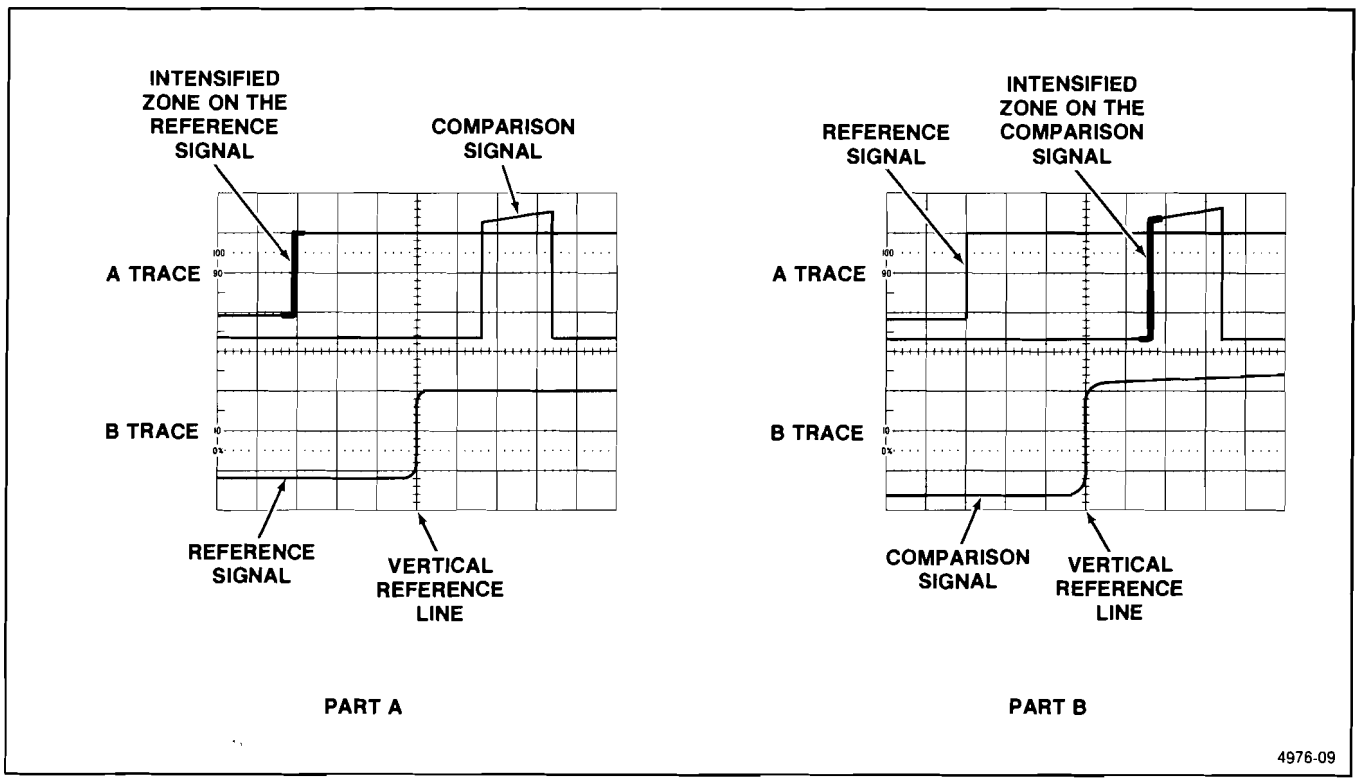


Figure 2-24. Time difference between two pulses on two time-related signals.

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. Detailed block diagram and 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 2235A Oscilloscope, refer to the detailed block diagram (Figure 9-4) located in the Diagrams section of this manual. In Figure 9-4, 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 input connector or the CH 2 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 ground (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 a Diode Gate circuit to enable either the vertical or trigger view signal to drive 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 the the operator can see the signal that triggered the sweep.

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

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

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

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

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

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

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

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

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

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

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

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

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

A front-panel CAL output is provided for use in adjusting probe compensation and for checking vertical deflection accuracy. The voltage at the CAL connector is a negative-going square wave that has a peak-to-peak amplitude of 0.5 V and a repetition rate of 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 and the CH 2 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.

Input Coupling

The signal applied to the CH 1 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 input connector are routed through resistor R1 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 R2 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 divider 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.

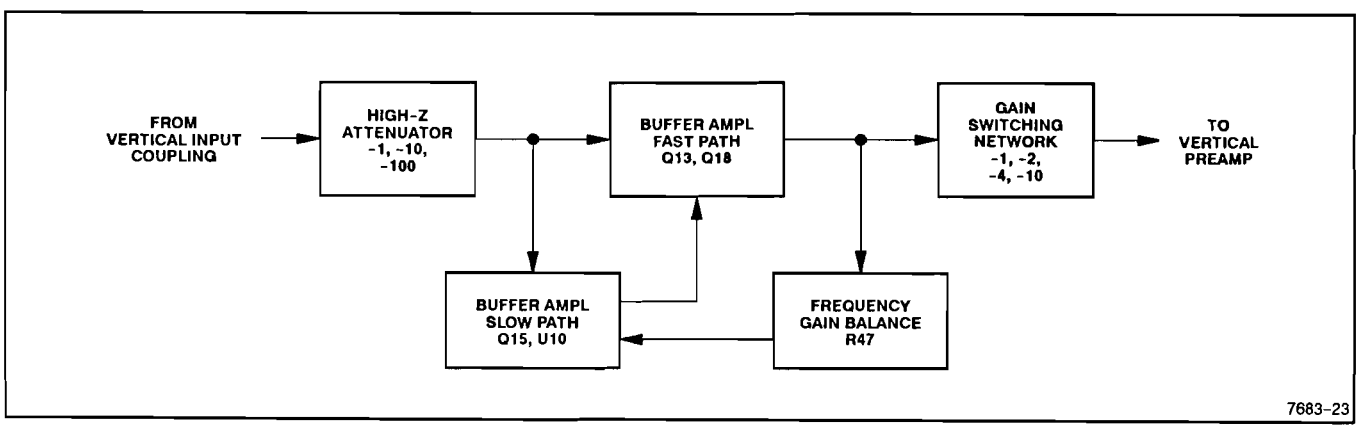


Figure 3-1. Block diagram of the Vertical Attenuators.

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 ohms 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 input 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. The input transistors buffer the signal voltages and drive the input differential pair. Emitter current for the differential input pair 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 differential input pair serves as emitter current for the two differential output transistor pairs. Base bias voltages for the two output pairs are generated by the current through the diodes at pins 7 and 14, and are controlled by R39 and the network composed of R41, R42, and variable gain control R43. Monolithic IC U30 has matched transistor characteristics, so the ratio of currents in the two diodes 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. Diodes CR85 and CR88 will route current from R91 and R92 to the output pair not connected to R89 through INVERT switch S90. When the switch is out, the transistor pairs in U80 are biased as they are in U30 and there is no trace inversion. For the IN position of S90, connections to the bases of the output transistor pairs are reversed to produce an inverted Channel 2 trace. Potentiometer R75 is adjusted so that there is minimal dc trace shift as the INVERT button is changed between the IN and OUT positions.

VERTICAL PREAMPLIFIERS

The Vertical 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 the crt display is controlled by the Channel Switch circuitry.

Cornmon-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 differential input pair is supplied by Q114 and Q115. POSITION control R112 adjusts the base voltages through U120A and B to provide position information. The collector current of the differential input pair of U130 serves as emitter current for two differential output pairs. One of the collectors of each output pair is grounded and the other provides output drive to the Delay Line Driver. The base voltages of the transistors with grounded collectors are held at ground potential by R136. The base voltages of the other transistors are controlled by the Channel Switch and Trigger View circuitry.

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

When TRIG VIEW push button S200 is pressed in, -8.6 V is applied to R138 and R188 to turn off the transistors in U130 and U180 with ungrounded collectors. Both Channel 1 and Channel 2 output signals are then conducted to ground. Zener diode VR200 turns on and CR200 and CR201 become reverse biased. Trigger View transistors Q440 and Q441 are then coupled to the Delay Line Driver through forward-biased diodes CR202 and CR203. The crt trace will then be a display of the A Trigger signal.

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 XY1 line connected to S550 is LO (through the saturated Q550 transistor). Vertical MODE switches S545 and S550 control the connection between the XY1 line and the PR and CL inputs of U540A to obtain the various display formats described below.

CHANNEL 1 DISPLAY ONLY. The CH 1 position of S550 applies a LO to the PR input of U540A while the CL input is held HI by R550, pin 7 (Diagram 4). 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.

CHANNEL 2 DISPLAY ONLY. The CH 2 position of S550 holds the CL input of U540A LO through CR538 and the PR input is held HI by R550, pin 8. 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 provide a LO signal to S545.

ADD DISPLAY. In the ADD position of S545, both the PR and CL inputs of U540A are held LO by CR537 and CR540. 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 CHOP_EN(L) 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.

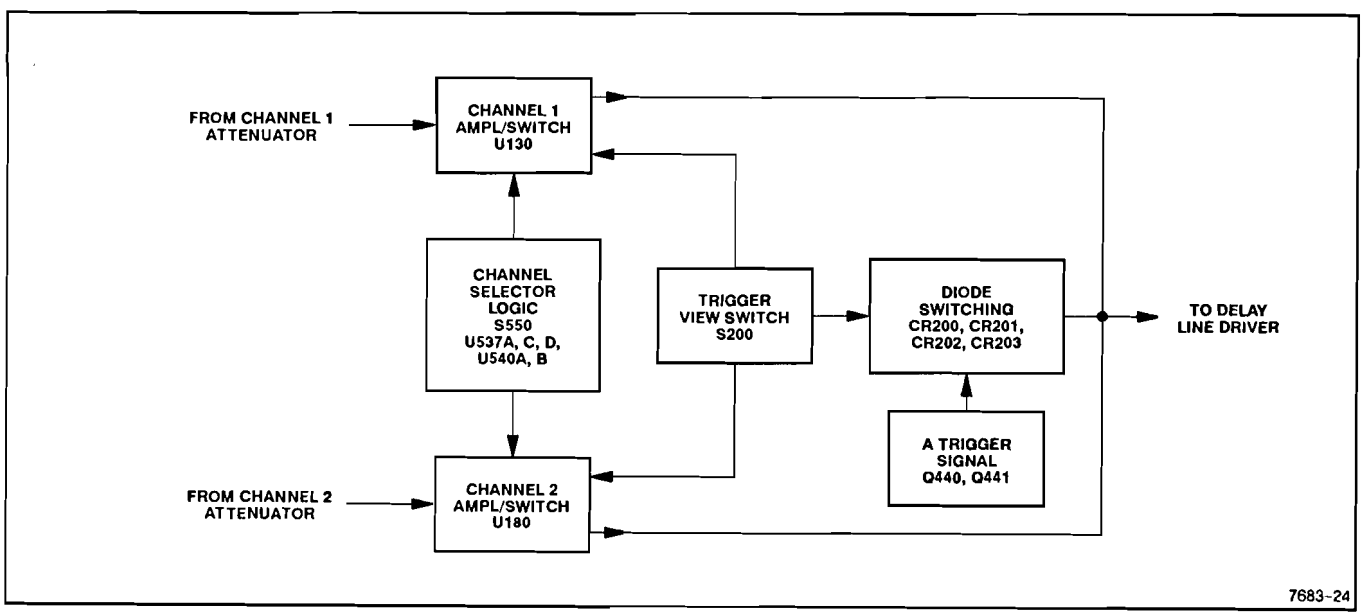


Figure 3-2. Block diagram of the Channel Switching circuitry.

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 PR and CL 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 CHOP_EN(L) 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 HI from U537C and the ALT_SYNC signal from the Holdoff circuitry in the A Sweep Generator. The output of U537A will then be the inverted ALT_SYNC signal which clocks U540A. This causes the outputs of U540A to toggle at the end of each sweep so that the Channel 1 and Channel 2 Preamplifier signals will alternately drive the Delay Line Driver.

Delay Line Driver

The Delay Line Driver, shown on Diagram 3, 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 DL9210 provides a vertical signal delay of about 90 ns so that the Sweep Generator has sufficient time to start 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. Overall gain is set by R233 with temperature compensation provided by RT236. The output stage of the amplifier utilizes two series-connected 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 (Diagram 10) changes output-amplifier biasing to limit the voltage swing at the crt plates. This keeps the vertical trace within the graticule area for locating off-screen traces. With the switch in the normal out position, the -8.6 V supply provides emitter current to the amplifier output stage through R261. When the BEAM FIND switch is in, the direct -8.6 V supply to R261 is removed and emitter current is now supplied through R261 and R262 in series. This reduces the amount of available emitter current and limits the amplifier dynamic range.

A/B Sweep Separation Circuit

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

During the A Sweep interval, the SEP(L) signal is HI and Q283 is turned on. The base voltages of Q284 and Q285 are then the same, and equal current is supplied to both sides of the Vertical Output Amplifier so that no offset of the A trace occurs.

TRIGGER AMPLIFIERS AND SWITCHING

The Trigger Amplifiers, shown on Diagram 4, provide signals to the Trigger Generator circuit from either the Vertical Preamplifiers, the EXT INPUT connector, or the power line. The A & B SOURCE switch selects either Channel 1, Channel 2, a composite of both, or, for A-Trigger, the EXT INPUT as the trigger source. The A COUPL switch offers a means of accepting or rejecting certain components of the trigger signals that are coupled to the A Trigger Generator and also selects line trigger.

Trigger Switching

Logic levels used to select the desired trigger mode are generated by programmed array logic (PAL), U555, depending on input signals from A & B SOURCE switch S555, A COUPL switch S392 and the two Vertical MODE switches S545 and S550 (+XY & U540). For the discussion below, the appropriate levels to implement the function will be mentioned, but if greater detail is desired, the inputs to U555 for the various switch settings are shown in Table 3-1 and the logic equations for the output levels are shown in Table 3-2.

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 CH1_TR(L) from line U555. When the CH1_TR(L) 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 CH1_TR(L) 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 sources are chosen by the A & B SOURCE switch with the A COUPL switch set to a position other than A LINE SOURCE. This causes a HI output on U555, pin 14, and a LO on pins 12 and 13, turning Q392 and Q399 ON, which reverse biases CR393 and CR399 to prevent external trigger signals or the line trigger signal from reaching the A Trigger Generator. Signals from the Internal Trigger Amplifier are passed to the A Trigger Generator through CR372, which is forward-biased because Q369 is OFF.

Table 3-1

Front Panel Trigger Switch Setting to PAL Input Decoding

SWITCH SETTINGS	PAL (U555) INPUTS					
	$\overline{XY}$ MODE			XY MODE		
A & B SOURCE	A	B		A	B	
VERT MODE	1	1		1	1	
CH 1	0	1		1	1	
CH 2	1	0		1	1	
A EXT	0	0		1	1	
A COUPLING	**C**	**D**		**C**	**D**	
NORM	1	1		1	1	
HF REJ	0	1		0	1	
LF REJ	1	0		1	0	
A LINE SOURCE	0	0		0	1	
VERTICAL MODE	**E**	**F**	**G**	**E**	**F**	**G**
CH 1	1	1	0	0	0	1
CH 2	1	0	1	0	0	1
BOTH ADD	1	0	0	0	0	1
BOTH ALT	0	1	1	0	0	1
BOTH CHOP	1	1	1	0	0	1

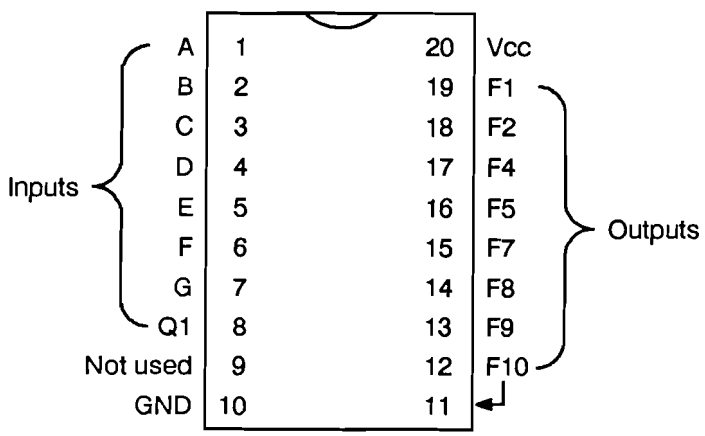
Input Q (Pin 8 of U555) is supplied by U565C.

Table 3-2
PAL Logic Implementation

Use the following equations with the input values from Table 3-1 to determine the value of the PAL outputs for different switch settings.

PAL OUTPUT				DEFINING EQUATION	PIN NUMBER
F1	=	$\overline{\text{CH 1 TR}}$	=	$A\bar{E}GQ + A\bar{E}FG + \bar{B}G + AE\bar{F}G + A\bar{E}F\bar{Q} + \bar{B}E + \bar{B}F$	19
F2	=	$\overline{\text{CH 2 TR}}$	=	$BF\bar{G}Q + B\bar{E}Q + B\bar{E}\bar{F} + BEF\bar{G} + \bar{A}$	18
F4	=	$\overline{\text{VALT}}$	=	$E\bar{F}$	17
F5	=	$\overline{\text{LF REJ}}$	=	$\bar{C}D$	16
F7	=	XY	=	$B\bar{E}\bar{F}$	15
F8	=	INT	=	BD + AD + BC + AC	14
F9	=	EXT	=	$\bar{A}BD + \bar{A}BC$	13
F10	=	LINE	=	$\bar{C}\bar{D}F + \bar{C}\bar{D}E + \bar{B}C\bar{D}$	12

2235A U555 Pin Assignment



CHANNEL 1. For triggering from Channel 1, the A & B SOURCE switch is set to CH 1. The output at U555, pin 19, will then be LO and the Channel 1 signal path through U310 will be enabled. The Channel 2 signal path is disabled by U555, pin 18, being HI.

CHANNEL 2. For triggering from Channel 2, the A & B SOURCE switch is set to CH 2. U555, pin 18, is LO and will enable the Channel 2 signal path through U335 while the HI output at U555, pin 19, will disable the Channel 1 path.

Vertical MODE. When the A & B SOURCE switch is set to VERT MODE, trigger source selection is determined by the two Vertical MODE switches, S545 and S550 (Diagram 2).

When Channel 1 is selected (Vertical MODE switches set to CH 1), CH1_TR(L) from U555, pin 19, is LO and pin 18 is HI and the Channel 1 signal will be selected.

When Channel 2 is selected (Vertical MODE switches set to CH 2), logic levels at pins 18 and 19 of U555 are LO and HI, respectively, and the Channel 2 signal is used.

When the Vertical MODE switches are set to BOTH-ALT, input at U565B, pin 3, is LO causing the output to be HI, which in turn enables a signal path through U565C. The CH2_VERT signal from U540A, pin 6 (Diagram 2), is inverted and applied to U555. Since this signal toggles with each sweep, the logic levels at pins 18 and 19 of U555 change at the same time, alternately selecting the trigger source to follow the displayed channel.

In the ADD Vertical MODE position, inputs at pins 6 and 7 of U555 are LO which causes output pins 18 and 19 to also 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 results in a HI on all three inputs to U565B, and this sets the output, CHOP_EN(L) LO. Pins 18 and 19 of U555 are again both LO, and the signal to the Internal Trigger Amplifier will be the same as for the ADD mode.

Internal Trigger Amplifier

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

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

A External Trigger Amplifier

The A External Trigger Amplifier buffers signals applied to the EXT INPUT connector to drive the A Trigger Generator. Input signal coupling is determined by A EXT COUPL switch S380 which selects AC, DC, or $\frac{DC}{10}$ 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 $\frac{DC}{10}$ position attenuates the input signal by a factor of 10 through the compensated divider composed of R377, C377, R378, R371, R379, C379, R380, C380, R381, 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. Q381 is connected as a protection-diode and clamps the signal at the gate of Q382A to about -9 V. The amplifier output will drive the A Trigger Generator through forward-biased CR393 whenever the A & B SOURCE switch is set to A EXT (except for LINE). When the A & B SOURCE switch is not set to A 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 to the A Trigger Generator when the A COUPL switch is in the A LINE SOURCE position.

Transformer T390 in the Power Supply (diagram 9) provides a line-frequency signal through R397 to Q397. Diode CR399 is forward biased when S392 is in the A LINE SOURCE position, and the emitter signals of Q397 will drive the A Trigger Generator.

A Trigger Bandwidth

With the A COUPL switch in NORM position, the base of Q409 is pulled to ground by Q374. LF_REJ from U555 is HI, turning off Q400 (Diagram 5). Output of Q400 is then low, turning on Q402, which supplies emitter current to Q405, turning it on. With Q402 turned on, Q405 acts as an emitter follower which drives the trigger input of U460 and the peak detectors. The voltage at the collector of Q400 is low enough to keep Q406 and CR406 turned off. Therefore, the only signal path is through Q405 to the peak detectors, which passes all frequency components of the trigger signal.

In the HF REJ mode of trigger coupling, Q374 is turned off by S392, turning on Q409 which bypasses high-frequency components of the trigger signal to ground, resulting in the attenuation of frequencies above approximately 40 kHz. Bias conditions on Q402, Q405, and Q406 (Diagram 5) remain the same as in the NORM setting.

In the LF REJ mode of trigger coupling, Q409 is turned off, disconnecting C409 from ground. The LF_REJ line is now LO, turning on Q400. This turns off Q402, which in turn, turns off Q405 and CR405. The only signal path is through Q406 to the trigger peak detectors. Transistor Q406 and CR406 are turned on by current supplied through R406. Capacitor C410 and R410 form a high-pass filter, resulting in the attenuation of frequencies below approximately 40 kHz.

A TRIGGER GENERATOR

The A Trigger Generator, shown on Diagram 5, supplies trigger signals to the A Sweep Generator. Included in the A Trigger Generator circuit are the P-P Auto Trigger, A Trigger Level comparator and Schmitt Trigger, and TV Triggering circuitry.

A Trigger Level Circuit

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

In the P-P Auto and TV Field modes, Q413 is off and CR414 and CR415 are reverse biased. Trigger signals selected by the A & B 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 and Q413 is turned on, which forward biases CR415. Input transistors Q420 and Q421 are then biased off and no trigger signals will reach the A Trigger Level circuit. The inputs and outputs of U426A and U426B will then be fixed voltages and independent of trigger-signal amplitude.

A Trigger Level Comparator and Schmitt Trigger

Integrated circuit U460 contains the Trigger level comparator and Schmitt Trigger circuitry. The output voltage of the A Trigger amplifier is applied to U460, pin 4. The other input to the comparator is the wiper voltage on the A TRIGGER LEVEL control, applied to pin 2 of U460 through zero-offset buffer Q446 and Q450. The resistor R452 and the voltage at pin 5 of U460 set the emitter current for the comparator.

The Trigger Slope is determined by the relative voltages on U460, pins 7 and 8. If pin 8 is at a higher level than pin 7, the plus output of U460 will change to a HI state when a positive-going input signal crosses the threshold at pin 2 of U460. With pin 8 more negative than pin 7, the Schmitt fires on a negative-going input. The voltage at pin 7 is fixed, while that at pin 8 is selected by the A TRIGGER SLOPE switch S460 through R459, R461, and R462.

The sensitivity of the Schmitt Trigger is controlled by the current at pin 9. The setting of R479 determines the circuit hysteresis.

The outputs of the Schmitt Trigger are at pins 10 and 12 of U460. The outputs are at ECL levels and are from emitter followers internal to U460. Collector voltage to U460 is supplied through pins 11 and 14. When TV Field is not selected, the TV_TRIG_ENABLE line connected to CR476 and R473 is LO. Transistors Q473 and Q474 are biased off which also biases Q487 off. Resistor R476 biases CR467 and CR477 on and the + Out Trigger signal from pin 10 of U460 passes through the diodes to U506-6 of the A Sweep Generator.

TV Trigger Circuit

When TV FIELD is selected, the TV_TRIG_ENABLE line is HI. This disconnects the high-speed trigger path by reverse-biasing CR467 and CR477. Setting the A Trigger Level threshold near the center of the horizontal sync-pulse swing causes the trigger IC U460 to output a pulse-train that corresponds to the sync-pulses of the TV signal. This pulse-train is filtered by R467, R468, C467, R469, R470, and C469, and applied to the bases of Q473 and Q474. Normally, the duty cycle of the horizontal sync-pulses is low, and the filtered average voltages of the pulse-train bias Q473 off and Q474 on. This causes Q487 to conduct, providing a LO to the sweep generator. When the TV-Vertical-Sync block occurs, the duty cycle of the horizontal sync-pulses increases, and the filtered average voltages of the pulse-train bias Q473 on and Q474 off, turning off Q487 and providing a positive-going signal to U506, pin 6, to initiate a sweep.

A SWEEP GENERATOR AND LOGIC

The A Sweep Generator and Logic circuitry, shown on Diagram 6, produces a linear voltage ramp that is amplified by the Horizontal Amplifier to provide horizontal deflection of the crt beam. The Sweep Generator circuits also produce signals that are used to generate correct timing of the crt unblanking and intensity levels used for viewing the display. See Figure 3-3 for the block diagram of the A Sweep Generator and Logic circuitry.

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

A Miller Sweep Generator

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

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

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

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

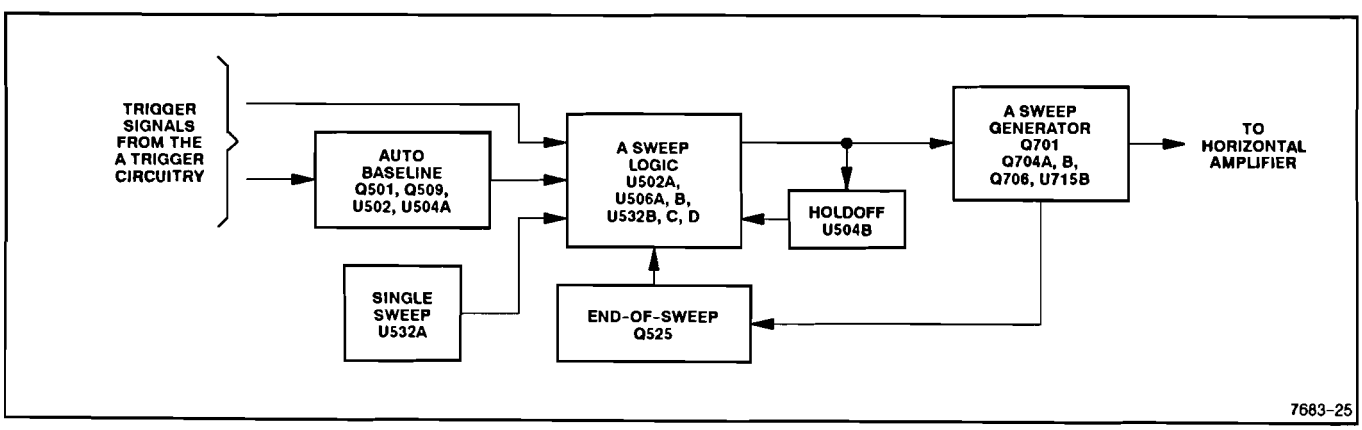


Figure 3-3. Block diagram of the A Sweep Generator and Logic circuitry.

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

The Sec/Div Variable circuitry utilizes an operational amplifier to maintain a constant reference voltage at one end of R721 independent of the circuit load. The voltage applied to the timing resistors varies with the rotational position of R721, the SEC/DIV Variable control. A fixed dc voltage is applied to the noninverting input of the operational amplifier and feedback resistors R717 and R718 establish approximately double that voltage at the anode of VR720.

A Sweep Logic

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

Incoming trigger signals from the output of U460 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 R506 and C501, the Q output will return 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 described in the P-P AUTO and TV FIELD section.

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

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

With U504B triggered, the $\overline{Q}$ output changes from HI to LO and will stay LO for a time duration determined by the Var Holdoff circuitry and the A SEC/DIV switch position. VAR HOLDOFF potentiometer R521 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 $\overline{Q}$ 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 single sweep 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 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 XY2(L) line is LO which holds the input of U523B LO through CR518. The output of U532B will hold U506A set and no sweeps can be initiated.

ALTERNATE B SWEEP

The Alternate B Sweep circuitry, shown on Diagram 7, produces a linear voltage ramp that is amplified by the Horizontal Amplifier to provide the B Sweep horizontal deflection on the crt. The Alternate B Sweep circuitry also produces the sweep-switching signals that control the display of the A and B Sweeps, and the gate signals used by the Intensity and Z-Axis circuits to establish the crt unblanking and intensity levels needed for producing both the A Intensified and B Sweep displays.

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

B Miller Sweep Generator

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

B Trigger Level Comparator and Schmitt Trigger

The B Trigger Level Comparator and Schmitt Trigger are contained in U605. This circuit determines both the trigger level and slope at which the B triggering signal is produced. It functions in the same manner as the A Trigger Level Comparator and Schmitt Trigger with the exclusion of the TV trigger circuitry. See the A Trigger Level Comparator and Schmitt Trigger section for a description of circuit operation. The + OUT terminal of U605 is directly connected to the clock input of U670A to initiate the B Sweep when the B trigger is utilized.

Runs After Delay

The Runs After Delay circuit allows the B Sweep Logic to generate a B Sweep independently of any B Trigger signals. In the Runs After Delay mode, B TRIGGER LEVEL control R602 is rotated fully clockwise. This biases off Q637 and places a LO on the collector. Inverter U660D will then have a HI output with resistor R640 providing positive feedback. This HI output reverse biases CR626, so the state of U670A is determined by the level at U660F pin 12.

If the B TRIGGER LEVEL control is not fully clockwise, Q637 is biased on and the B Sweep is in the triggered mode. The output of U660D will be LO which keeps the S input of U670A LO, preventing the flip flop from being set by the output of U660F.

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

B Delay Time Position Comparator

The B Delay Time Position Comparator circuit compares the amplitude of the A Sweep sawtooth output voltage to the dc voltage level set by B DELAY TIME POSITION potentiometer R9644. The output of the comparator is used to initiate a B Sweep and to control the B Z-Axis Logic circuit switching.

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

The output of the comparator is enabled or disabled by the strobe signal connected to pin 6. When the A_ONLY(L) signal is HI, the comparator is enabled. When the A_ONLY(L) signal is LO, the output of the comparator is a high impedance and therefore a HI is present on pin 9 of U680C.

B Sweep Logic

The B Sweep Logic circuitry utilizes signals from the associated B Sweep circuitry to generate control signals

for both the B Miller Sweep and the B Z-Axis Switching Logic circuits.

In the Runs After Delay mode CR626 is reverse-biased, and a LO is placed on the D input of U670A. During the previous holdoff period, U680D pin 13 strobed LO. The output of the flip-flop composed of U680C and U680D went HI and the output of U660F went LO. This placed a LO on the S input of U670A and a HI on the R input, causing the flip-flop to be reset. The LO on pin 2 and HI on pin 3 of U670A are converted to TTL levels by Q630 and Q631. The resulting HI on the collector of Q630 turns Q709 on, preventing the B Miller Sweep from running. Once the A Sweep voltage at U655, pin 3, exceeds the voltage at pin 2, the comparator output will go LO. The U680C-U680D flip-flop will change output states and cause U670A to be set. Q709 is shut off and the B Miller Sweep Generator will produce a linear ramp. This also sets the output of U665D LO to unblank the trace. If the B Sweep ramp voltage reaches about 12 V, sweep-end comparator Q643 will turn on and cause the output of U665D to go HI. The B Miller Sweep Generator will continue to run, but the trace will be blanked because the B_GATE(L) line is HI which reverse biases CR817. Once the ramp is at approximately 13 V, VR712 will conduct and prevent the voltage from increasing further.

The B Sweep Generator will be reset for another sweep by one of two means. If the A Sweep doesn't end before the B Sweep, the Generator will not be reset until the ALT_SYNC line goes from HI to LO to change the U680C-U680D flip-flop output states. The R input of U670A goes HI causing the collector of Q630 to be HI, resetting the B Sweep Generator. Depending on the settings of the A AND B SEC/DIV switches, the A Sweep may end before the B Sweep. If this occurs, the ALT_SYNC line will go LO at the end of the A Sweep and cause an immediate resetting of the Generator. In either case, a new sweep will be initiated the next time the A Sweep voltage at U655, pin 3, exceeds the voltage at pin 2.

When not in the Runs After Delay mode, the output of U660Dis LO, a HI is placed on the D input of U670A, and the circuitry connected to U660F operates as described above. When the output of U660F goes HI, U660A no longer holds U670A reset, allowing the Q output to be clocked HI by the first B trigger signal from U605. The collector of Q630 will go LO initiating a B Sweep.

Alternate Display Switching Logic

The Alternate Display Switching Logic circuitry controls both the Horizontal Amplifier sweep switching and the B Z-Axis Logic switching.

Horizontal MODE switch S648 selects the input logic levels that are applied to the circuitry. In the A Horizontal Mode, the R input of U670B is held HI through Q670, and the S input is LO. This holds U670B reset. The LO on pin 15 and HI on pin 14 result in the A_DISP line at the collector of Q684 being HI, which allows only the A Sweep to be passed to the Horizontal Amplifier. In the B Horizontal mode, U670B is held set, allowing only the B Sweep to reach the Horizontal Amplifier.

With S648 set to ALT, and for all settings of the Vertical MODE switches except BOTH-ALT, the VALT2(L) signal applied to U660E is HI while the S and R inputs of U670B are both LO. The LO output of U660E causes the output of U680B to be HI, and whenever the ALT_SYNC signal applied to pin 1 of U680A goes LO, the gate output will change from LO to HI and clock U670B. The outputs of U670B will toggle with each ALT_SYNC signal transition to alternately enable the A and B Sweeps to reach the Horizontal Amplifier. Whenever the B Sweep is selected for display , the collector of Q687 is HI, and this level is applied to U665C, pin 10. Pin 9 is also HI, so the SEP(L) signal from U665C will be LO to enable the A/B Sweep Separation circuitry.

When the CH 1-BOTH-CH 2 Vertical MODE switch is set to BOTH, the ADD-ALT-CHOP switch becomes functional. In the ALT Vertical MODE position the VALT2(L) signal is LO, the HALT signal is HI, and the CH1_SELECTED signal is a TTL square wave that switches states at the end of the A Sweep. Input pin 4 of U680B will be HI and the gate output will be the inverse of the CH1_SELECTED signal. This output signal is NANDed with the ALT_SYNC signal by U680A to clock U670B. Whenever the ALT_SYNC signal goes LO at the end of a sweep and the CH1_SELECTED signal switches from LO to HI, U670B will be clocked. Since only positive transitions on the clock input will cause the flip-flop to change output states, two A Sweeps are required to cause the flip-flop output levels to switch. With this switching arrangement, the crt will first display the two A Intensified Sweeps and then the two Alternate B Sweeps.

B Z-Axis Logic

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

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

When the A Sweep is displayed, the collector of Q682 is LO and that of Q683 is HI. CR687 is turned on, reverse biasing CR817, preventing Z-axis drive current from flowing through the diode. With CR684 reverse biased, additional Z-axis drive current to intensify the A Sweep will be supplied whenever CR685 is biased off. Since input pin 5 of U665B is HI, the gate output and therefore the conductive state of CR685 is determined by the B_GATE(L) signal through U660C. Whenever the B Sweep is running, the output of U665D will be LO. This will cause the output of U665B to also be LO and CR685 will be biased off. If the B Sweep is not running, the output of U665B will be HI and CR685 will be biased on. This will bias off CR816 and the A Sweep will not be intensified.

If U670B is set to display the B Sweep (Q HI and $\overline{Q}$ LO), CR684 will be biased on, reverse biasing CR816 to prevent Z-axis drive through that diode. With CR687 off, the B Sweep will be displayed if CR680 is also reverse biased. Whenever the B Sweep is running, the output of U665D will be LO. Diode CR680 will then be reverse biased and Z-Axis drive current will flow through CR817. If the B Sweep is not running, the output of U665D is HI, forward biasing CR680 and therefore reverse biasing CR817. No Z-Axis drive current can then flow through CR817.

HORIZONTAL

The Horizontal Amplifier circuit, shown on Diagram 8, provides the output signals that drive the horizontal crt deflection plates. Signals applied to the Horizontal Preamplifier can come from either the A or the B Miller Sweep Generator (for sweep deflection) or from the XY Amplifier (when X-Y display mode is selected). Sweep switching is under control of the Alternate Display Switching Logic circuit. See Figure 3-4 for the block diagram of the Horizontal Amplifier.

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

Horizontal Preamplifier

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

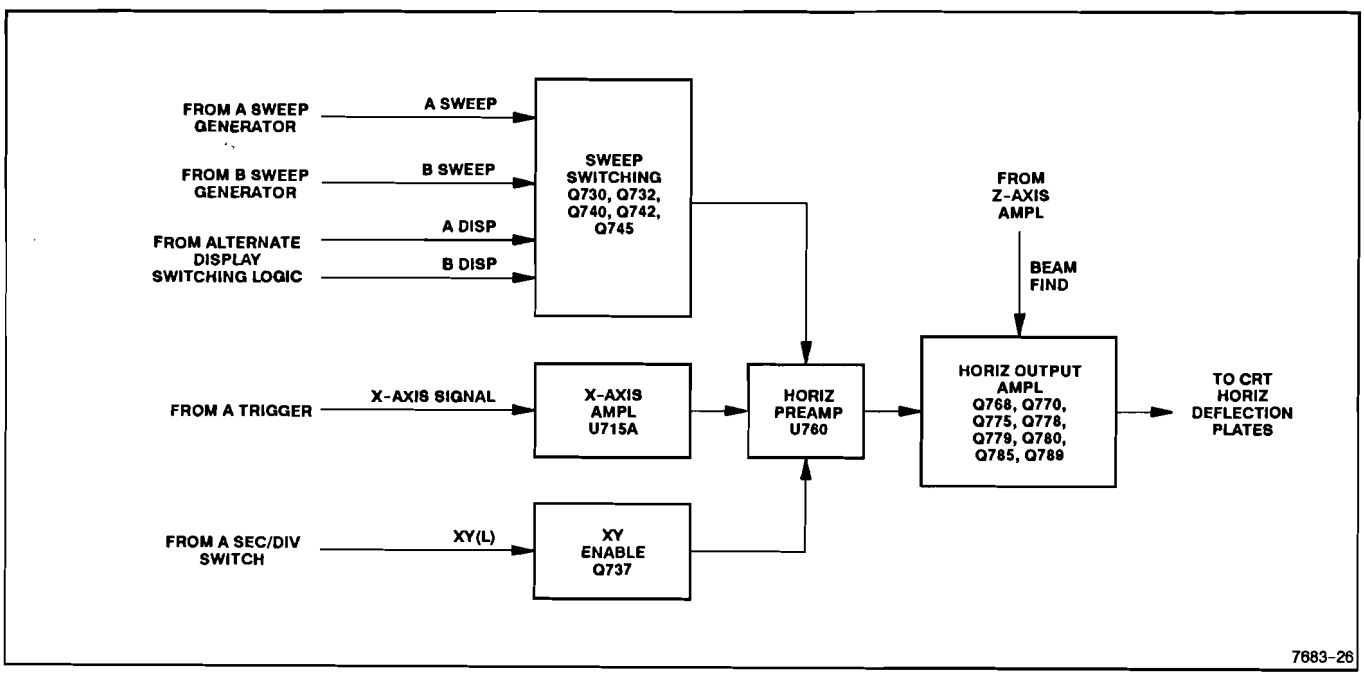


Figure 3-4. Block diagram of the Horizontal Amplifier.

The A and B Sweeps, selected by U670B in the Alternate Sweep circuitry, are applied to the bases of Q742 and Q732 respectively through gain potentiometers R740 and R730. The transistors are biased into active or cutoff regions by the control voltage applied at the bases of Q730 and Q740. Switching between the A and B Sweeps occurs within U760, with a negative input at pin 10 or 9 disconnecting the respective sweep from the rest of the amplifier. The Horizontal POSITION control adjusts the crt trace position through pin 14. Output bias current levels are set by R751 at pin 5 and frequency compensation for X-Axis signals is provided by C751 connected to pin 13.

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

X-Y Amplifier

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

When the X-Y mode is selected, Q737 is biased on to establish a HI on U760, pin 12, so that the A and B Sweeps are disconnected from the Preamplifier outputs. The input voltage from the Horizontal POSITION control at pin 14 is disconnected within U760, but position information is provided through R758 where it is summed with the X-Axis signal from U350, pin 16, (Diagram 4) to drive the inverting input of U715A through R757, R763, and RT763. The output of U715A will then be a function of the X-Axis signal and the Horizontal POSITION control wiper voltage. The X-Axis signal gain is adjusted by R760. The input signal at pin 11 from U715A will be converted to a differential output signal and applied to the Horizontal Output Amplifier.

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 Q768 and Q778 are at nearly the same dc level due to base-emitter voltages of Q770 and Q780.

Transistors Q768, 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 Q778, 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. C774 and R774 adjust the horizontal system response for proper high-speed timing at 5 ns/div.

The BEAM FIND function is implemented when S390 (Diagram 10) 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.

Calibrator

The Calibrator circuitry uses a hex inverter digital microcircuit to generate a 0.5V, 1 kHz, negative-going square wave. U985B and U985C are configured as a standard, astable multivibrator. To provide negative feedback and cancel errors caused by variations in the switching thresholds of the gates, U985A and its associated circuitry are added in the feedback loop for U985B. R990 adjusts the operating frequency for 1 kHz. The output voltage of U985D and U985E swings from -8.6 V to ground. R984, R991, and R992 attenuate the output signal with R984 adjusted to provide a 0 to -0.5V amplitude square-wave signal at the CAL output connector. R993, CR986, and CR989 provide protection. U985F supplies a 1kHz reference oscillator signal to the Scale Illumination circuitry on Diagram 10.

Z-AXIS AMPLIFIER

The Z-Axis Amplifier, shown on Diagram 10, controls the crt intensity level via several input-signal sources. The effect of these input signals is either to increase or decrease trace intensity or to completely blank portions of the display. The Z-Drive signal current as determined by the A and B Z-Axis Switching Logic and the input current from the EXT Z AXIS INPUT connector (if in use) are summed at the emitter of common-base amplifier Q825 and thereby determine the collector current of the

stage. This transistor provides a low-impedance termination for the input signals and isolates the signal sources from following stages of the Z-Axis Amplifier.

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

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

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

When only the A Sweep is displayed, Q586 and Q583 are biased off. The current through R818, as set by the A INTENSITY potentiometer, will flow through CR818 and Q825 to fix the voltage level at the Z-Axis Amplifier output. For a B-only display, Q586 is biased on to reverse bias CR818 and prevent A-intensity current from reaching Q825. Current determined by the base voltage of Q814 will flow through CR817 (Diagram 7) to Q825 and determine the B Sweep intensity. For an alternating A and B display, Q586 will be biased off when the A Sweep is displayed. During the portion of the A Sweep in which the B Sweep runs, current from R816 (Diagram 7) is allowed to flow through CR816 by the B Z-Axis Logic circuit to provide an intensified zone.

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

For an X-Y display, CR818, CR817, and CR816 are reverse biased. The XY2(L) signal is LO to reverse bias CR551 and allow current in R820 to flow through CR820. The crt intensity is then controlled by the A INTENSITY potentiometer which sets the current in R820 through Q804.

BEAM FIND switch S390 controls the base bias voltages of Q825 and Q829. When the BEAM FIND button is out, -8.6 V is supplied to a base biasing network. When the button is pushed in, the -8.6 V supply is removed and the voltage at the anode of VR828 rises to about -5.6 V. This turns off Q829 so that the amplifier output voltage is determined by R835 and the voltage at the BEAM FIND switch, as set by other parts of the Beam Find circuitry. The output voltage of Q835 will then be at a fixed level so that the INTENSITY controls and the Z-Drive signal have no control over the crt intensity. 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 ±100V, 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.

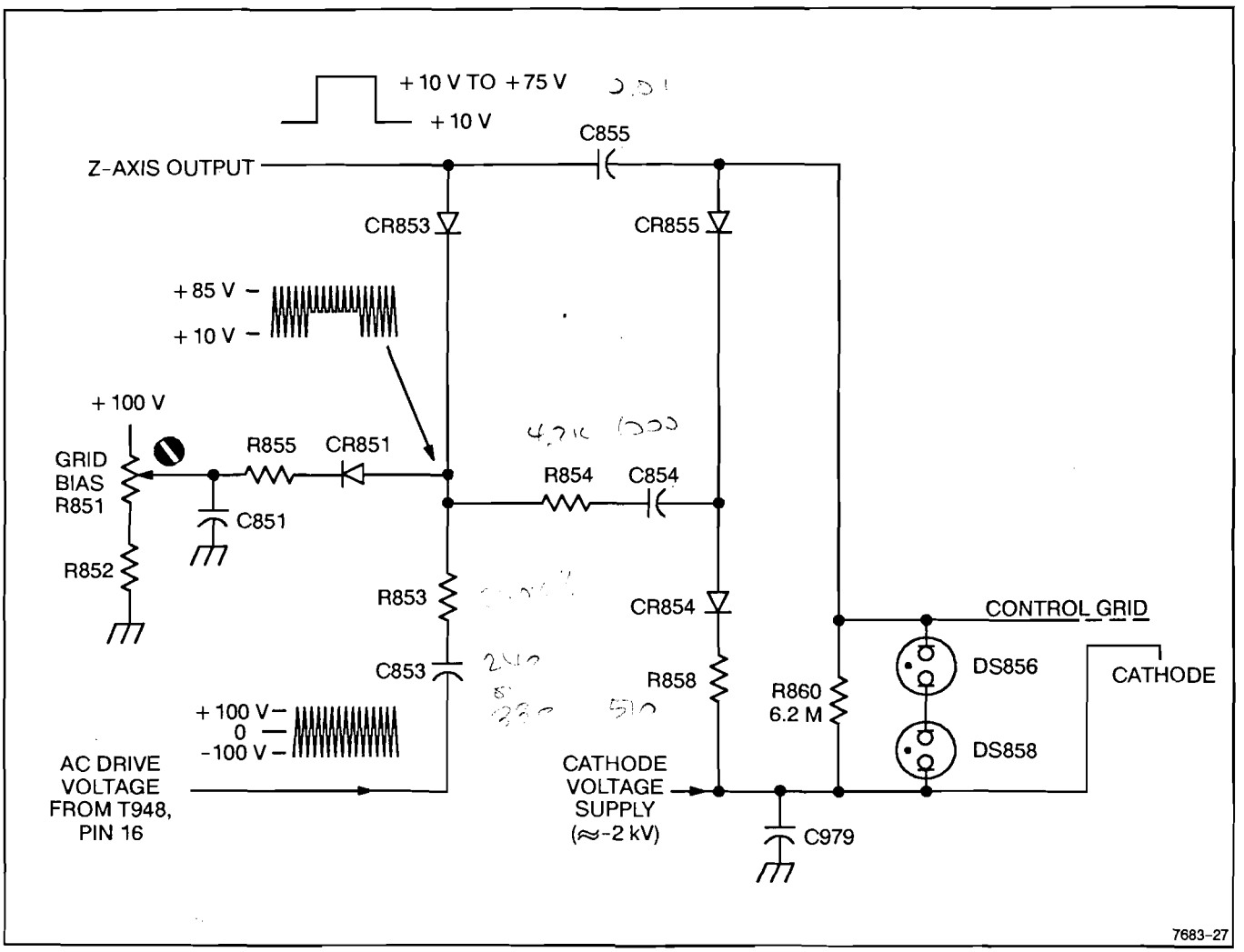


Figure 3-5. Simplified diagram of the Dc Restorer circuitry.

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. 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 SCALE ILLUMINATION

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 (Diagram 9) 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 RV901. Conducted interference originating within the power supply is attenuated by common-mode transformer T901, differential-mode transformer T903, line filter FL9001, and capacitors C900, C902, and C903.

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 (shown on Diagram 10). 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. 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 Adjust 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 (Diagram 10) utilizes the 2-kV winding of T948 to generate 12 kV to drive the crt anode. It also uses an internal half wave rectifier diode to produce -2 kV for the crt cathode. The -2 kV supply is filtered by a low-pass filter composed of C975, C976, R976, R978, and C979. Neon lamp DS870 protects against excessive voltage between the crt heater and crt cathode by conducting if the voltage exceeds approximately 75 V.

Focus Circuit

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

Low-Voltage Supplies

The low-voltage supplies utilize center-tapped secondary windings of T948. The + 102 V supply uses CR954

and CR955 for rectification and C954 for filtering. Diodes CR956 and CR957 rectify ac from taps on the 102 V winding, and C956, L956, and C957 filter 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, L968, and C970.

Scale Illumination

The Scale Illumination circuitry uses a variable pulse width modulator to control the brightness of the scale illumination lights. A 1 kHz reference oscillator signal is provided by the Calibrator circuit (Diagram 8). This signal is input to U882A, which is an integrator with DC offsets degraded by R887. The output of U882A is a ramp that is coupled to one input of U882B. A voltage level determined by the SCALE ILLUM control, R882, is connected to the other input of U882B. The two voltages are compared by U882B. If the ramp voltage is above the control voltage, Q882 is turned on, turning on lights DS881 and DS882. When the ramp voltage falls below the control voltage, Q882 is biased off, turning off the lights. The width of the pulses at the output of U882B determines the brightness of the lights.

PERFORMANCE CHECK PROCEDURE

INTRODUCTION

PURPOSE

The Performance Check Procedure is used to verify the instrument's Performance Requirements 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

The Performance Check 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 6. 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 or not the 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 10 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
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: 1 V. Repetition rate: 1 MHz. Rise time: 1 ns or less. Flatness: ±0.5%.	Vertical and horizontal checks and adjustments.	TEKTRONIX PG 506A Calibration Generator. [a]
Leveled Sine-Wave Generator	Frequency: 250 kHz to above 100 MHz. Output amplitude: variable from 10 mV to 5 V p-p. Output impedance: 50 Ω. 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]
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]
Low-Frequency Generator	Frequency: 1 kHz to 500 kHz. Output amplitude: 300 mV. Output impedance: 600 Ω. Reference frequency: 1 kHz. Amplitude accuracy: constant within 0.3 dB of reference frequency as output frequency changes.	Low frequency trigger checks.	TEKTRONIX SG 502 Oscillator.
Cable (2 required)	Impedance: 50 Ω. Length: 42 in. Connectors: BNC.	Signal interconnection.	Tektronix Part Number 012-0057-01.
Precision Coaxial Cable	Impedance: 50 Ω. Length: 42 in. Connectors: BNC.	Vertical bandwidth and aberrations checks.	Tektronix Part Number 012-0482-00.
Termination (2 required)	Impedance: 50 Ω. Connectors: BNC.	Signal termination.	Tektronix Part Number 011-0049-01.
Termination	Impedance: 600 Ω. Connectors: BNC.	Signal termination.	Tektronix Part Number 011-0092-00.
Dual Input Coupler	Connectors: BNC-Female-to-Dual-BNC-male	Vertical and X-Y checks and adjustments.	Tektronix Part Number 067-0525-02.

Table 4-1 (cont)

Item No. and Description	Minimum Specification	Purpose	Examples of Suitable Test Equipment
10X Attenuator	Ratio: 10X. Impedance: 50 Ω. Connectors: BNC.	Vertical compensation and triggering checks.	Tektronix Part Number 011-0059-02
T-Connector	Connectors: BNC.	Signal Interconnection.	Tektronix Part Number 103-0030-00.
Adapter	Connectors: Probe Tip to BNC.	Signal Interconnection.	Tektronix Part Number 013-0084-02.
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]
Test Oscilloscope with included 10X Probe	Bandwidth: dc to 10 MHz. Minimum deflection factor: 5 mV/div. Accuracy: ±3%.	Holdoff check and general troubleshooting.	TEKTRONIX 2213 Oscilloscope.
DC Voltmeter	Range: 0 to 2500 V, calibrated to 1% accuracy at -2000 V.	High-voltage power supply check.	Valhalla Model 4500 H.V. Digital Multimeter.
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.**

INDEX TO PERFORMANCE CHECK STEPS

VERTICAL

Equipment Required (See Table 4-1):

Calibration Generator
Leveled Sine-Wave Generator
50-Ω BNC Coaxial Cable
50-Ω BNC Termination
50-Ω BNC Precision Coaxial Cable
Dual-Input Coupler
10X BNC Attenuator

INITIAL CONTROL SETTINGS

Vertical (Both Channels)

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

Horizontal

POSITION	Midrange
MODE	A
A and B SEC/DIV	0.2 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	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 input connector.

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

c. 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.

d. Move the cable from the CH 1 input connector to the CH 2 input connector. Set the Vertical MODE switch to CH 2.

e. Repeat part b using the Channel 2 controls.

Table 4-2
Deflection Accuracy Limits

VOLTS/DIV Switch Setting	Standard Amplitude Signal	Vertical Deflection (Divisions)	Accuracy Limits (Divisions)
2 mV	10 mV	5	4.90 to 5.10
5 mV	20 mV	4	3.92 to 4.08
10 mV	50 mV	5	4.90 to 5.10
20 mV	0.1 V	5	4.90 to 5.10
50 mV	0.2 V	4	3.92 to 4.08
0.1 V	0.5 V	5	4.90 to 5.10
0.2 V	1 V	5	4.90 to 5.10
0.5 V	2 V	4	3.92 to 4.08
1 V	5 V	5	4.90 to 5.10
2 V	10 V	5	4.90 to 5.10
5 V	20 V	4	3.92 to 4.08

2. Check Position Range

a. Set:

VOLTS/DIV (both)	10 mV
Input Coupling (both)	AC

b. Set the generator to produce a 0.2-V standard-amplitude signal.

c. CHECK—The bottom of the waveform can be positioned at least 1 division above the center horizontal graticule line when the Channel 1 POSITION control is rotated fully clockwise, and that the top of the waveform can be positioned one division below the center horizontal graticule line when the Channel 1 POSITION control is rotated fully counter-clockwise.

d. Move the cable from the CH 2 input connector to the CH 1 input connector and set the Vertical MODE switch to CH 1.

e. Repeat part c using the Channel 1 controls.

3. Check Trigger View Gain

a. Set:

Vertical POSITION (both)	Midrange
VOLTS/DIV (both)	0.1 V
VOLTS/DIV Variable (both)	CAL detent

b. Press and hold in the TRIG VIEW button, vertically center the display with the A TRIGGER LEVEL control.

c. CHECK—Display amplitude is 1.6 to 2.4 divisions while holding in the TRIG VIEW button.

d. Move the cable from the CH 1 input connector to the CH 2 input connector and set the Vertical MODE switch to CH 2.

e. Repeat parts b and c.

f. Move the cable from the CH 2 input connector to the EXT INPUT connector. Set the A & B SOURCE switch to A EXT.

g. Repeat parts b and c.

h. Set the A EXT COUPL switch to DC.

i. Repeat parts b and c.

j. Set the A EXT COUPL switch to $\frac{DC}{10}$.

k. Set the generator to produce a 5-V signal.

l. Repeat parts b and c.

m. Disconnect the test equipment from the instrument.

4. Check Bandwidth

a. Set:

BW LIMIT	Off (button out)
VOLTS/DIV (both)	2 mV
Input Coupling (both)	DC
A SEC/DIV	20 μs

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

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 input connector to the CH 1 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.

Table 4-3
Settings for Bandwidth Checks

VOLTS/DIV Switch Setting	Generator Output Frequency
2 mV	90 MHz
5 mV	100 MHz

5. Check Bandwidth Limit Operation

a. Set:

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

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

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

d. CHECK—Generator output frequency is between 18 and 22 MHz.

e. Disconnect the test equipment from the instrument.

6. Check Common-Mode Rejection Ratio

a. Set:

BW LIMIT	Off (button out)
VOLTS/DIV (both)	10 mV
INVERT	On (button in)

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

c. Set the generator to produce a 50-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 50-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.

7. Check Channel Isolation

a. Set:

Vertical MODE	CH 1
CH 1 VOLTS/DIV	1 V
CH 2 VOLTS/DIV	0.5 V
VOLTS/DIV Variable (both)	CAL detent
INVERT	Off (button out)
Channel 2 Input Coupling	GND
A SEC/DIV	0.1 μs

b. Connect the leveled sine-wave generator output via a 50-Ω precision cable and a 50-Ω termination to the CH 1 input connector.

c. Set the generator to produce a 50-MHz, 5-division display.

d. Set the CH 1 VOLTS/DIV switch to 0.5 position.

e. Set the Vertical MODE switch to CH 2.

f. CHECK—Display amplitude is 0.1 division or less.

g. Move the cable from the CH 1 input connector to the CH 2 input connector.

h. Set:

Vertical MODE	CH 1
Channel 1 Input Coupling	GND
Channel 2 Input Coupling	DC

i. CHECK—Display amplitude is 0.1 division or less.

j. Disconnect the test equipment from the instrument.

HORIZONTAL

Equipment Required (See Table 4-1):

Calibration Generator	Low-Frequency Generator
Leveled Sine-Wave Generator	50-Ω Coaxial Cable
Time-Mark Generator	50-Ω BNC Termination

INITIAL CONTROL SETTINGS

Vertical

POSITION	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	AC

Horizontal

POSITION	Midrange
MODE	A
A SEC/DIV	0.05 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise

B TRIGGER

SLOPE	OUT
LEVEL	RUNS AFTER DLY (fully clockwise)

A TRIGGER

VAR HOLDOFF	NORM
Mode	NORM
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	DC

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 input connector.

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

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

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

e. CHECK—Timing accuracy is within 2% (0.16 division at the 10th vertical graticule line), and linearity is within 5% (0.1 division over any 2 of the center 8 divisions).

NOTE

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

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

g. Set:

A SEC/DIV	0.05 μs
X10 Magnifier	On (knob out)

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
A Sweep Only		
0.1 s	0.1 s	10 ms
0.2 s	0.2 s	20 ms
0.5 s	0.5 s	50 ms

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 3% (0.24 division at the 10th vertical graticule line) and linearity is within 5% (0.1 division over any 2 of the center 8 divisions). Exclude any portion of the sweep past the 100th magnified division.

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

l. Set:

Horizontal MODE	B
A SEC/DIV	0.1 μs
B SEC/DIV	0.05 μs
X10 Magnifier	Off (knob in)
A TRIGGER Mode	P-P AUTO

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

2. Check Variable Range and Sweep Separation

a. Set:

Horizontal MODE	A
A and B SEC/DIV	0.2 ms
SEC/DIV Variable	Fully counter-clockwise
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.

d. Set:

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

e. Use the Channel 1 POSITION control to set the A Sweep at the center horizontal graticule line.

f. CHECK – The B Sweep can be positioned more than 3.5 divisions above and below the A Sweep when the A/B SWP SEP control is rotated fully clockwise and counterclockwise respectively.

3. Check Delay Time Dial Range and Accuracy

a. Set the B DELAY TIME POSITION dial fully counter-clockwise.

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

c. CHECK – Intensified portion of the trace starts within 0.5 division of the start of the sweep.

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

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

f. Set:

A and B SEC/DIV	0.5 μs
B DELAY TIME POSITION	Fully counter-clockwise

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

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

i. Repeat parts d and e.

j. Set:

Channel 1 Input Coupling	DC
Horizontal MODE	B
A SEC/DIV	0.5 μs
B SEC/DIV	0.05 μs
B DELAY TIME POSITION	1.00

k. Select 0.5-μs time markers from the time-mark generator.

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

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

n. CHECK—The B DELAY TIME POSITION dial setting is between 8.910 and 9.090.

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

Table 4-5

Settings for Delay Time Accuracy Checks

A SEC/DIV Switch Setting	B SEC/DIV Switch Setting	Time-Mark Generator Setting
0.5 μs	0.05 μs	0.5 μs
5 μs	0.5 μs	5 μs
0.5 ms	50 μs	0.5 ms
5 ms	0.5 ms	5 ms

p. Set:

A SEC/DIV	0.1 ms
B SEC/DIV	10 μs
B DELAY TIME POSITION	1.00

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

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

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

t. CHECK—The B DELAY TIME POSITION dial setting is 0.980 to 1.020 greater than the previous setting.

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

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

4. Check Delay Jitter

a. Set:

A SEC/DIV	0.5 ms
B SEC/DIV	0.5 μs
B DELAY TIME POSITION	10.00

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

c. Rotate the B DELAY TIME POSITION control counterclockwise to position a time marker within

the graticule area for each major dial division and CHECK that the jitter on the leading edge of the time marker does not exceed 0.5 division. Disregard slow drift.

5. Check Position Range

a. Set:

Horizontal MODE	A
A SEC/DIV	10 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 counter-clockwise.

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
A 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 4.85 to 5.15 horizontal divisions.

e. Disconnect the test equipment from the instrument.

7. Check X-Y Phasing

a. Connect the output of the low-frequency generator to the CH 1 OR X and CH 2 OR Y input connectors via a 50-Ω cable and a 50-Ω termination, and a dual-input coupler.

b. Set:

Channel 2 Input Coupling	DC
CH 2 VOLTS/DIV	10 mV

c. Adjust the leveled sine-wave generator for an 8-division horizontal display at 150 kHz.

d. Center the display vertically and horizontally with the Horizontal POSITION and Channel 2 POSITION controls.

e. CHECK—Display for an opening at the center horizontal graticule line of 0.4 division or less.

f. Disconnect the test equipment from the instrument.

8. Check X Bandwidth

a. Connect the output of the leveled sine-wave generator to the CH 1 OR X input connectors via a 50-Ω cable and a 50-Ω termination.

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

c. Increase the generator output frequency of 2.5 MHz.

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

e. Disconnect the test equipment from the instrument.

9. Check Sweep Length

a. Set the A SEC/DIV control to 0.1 ms and position the start of the sweep at the first vertical graticule line using the Horizontal POSITION control.

b. CHECK—End of the sweep is to the right of the 11th vertical graticule line.

TRIGGER

Equipment Required (See Table 4-1):

Leveled Sine-Wave Generator
50-Ω BNC Coaxial Cable
50-Ω BNC Termination

INITIAL CONTROL SETTINGS

Vertical (Both Channels)

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

Horizontal

POSITION	Midrange
MODE	A
A and B SEC/DIV	0.2 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise

B TRIGGER

SLOPE	Positive (button out)
LEVEL	Midrange

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	DC

PROCEDURE STEPS

1. Check Internal A and B Triggering

a. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 1 input connector.

b. Set the generator to produce a 10-MHz, 3.5-division display.

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

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

Table 4-6
Switch Combinations for A Triggering Checks

A TRIGGER Mode	A TRIGGER SLOPE
NORM	Positive
NORM	Negative
P-P AUTO	Negative
P-P AUTO	Positive

e. Set the Horizontal MODE switch to B.

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

g. Set:

Vertical MODE	CH 2
A & B SOURCE	CH 2
Horizontal MODE	A

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

i. Repeat parts d through f.

j. Set:

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

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

l. Repeat parts d through f.

m. Set:

Vertical MODE	CH 1
A & B SOURCE	VERT MODE
Horizontal MODE	A

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

o. Repeat parts d through f.

p. Set:

Horizontal MODE	A
A SEC/DIV	0.05 μs

q. Set the generator to produce a 100-MHz, 1.5-division display.

r. Repeat parts d through f.

s. Set:

Vertical MODE	CH 2
Horizontal MODE	A

t. Move the cable from the CH 1 input connector to the CH 2 input connector.

u. Repeat parts d through f.

v. Disconnect the test equipment from the instrument.

2. Check External Triggering

a. Set:

Vertical MODE	CH 1
Horizontal MODE	A
X10 Magnifier	Off (knob in)
A & B SOURCE	EXT

b. Connect a 35-mV, 10-MHz signal from the leveled sine-wave generator via a 50-Ω cable and a 50-Ω termination to the EXT INPUT connector.

c. Press and hold in the TRIG VIEW button.

d. CHECK – Stable display can be obtained by adjusting the A TRIGGER LEVEL control for each switch combination given in Table 4-6. Then release the TRIG VIEW button.

e. Set the generator output voltage to 120 mV and the frequency to 60 MHz. Set the X10 Magnifier to On (knob out).

f. Repeat parts c and d.

g. Set the generator output voltage to 150 mV and the frequency to 100 MHz.

h. Repeat parts c and d.

i. Disconnect the test equipment from the instrument.

3. Check External Trigger Ranges

a. Set:

CH 1 VOLTS/DIV	0.5 V
A SEC/DIV	20 μs
X10 Magnifier	Off (knob in)
A 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 A TRIGGER LEVEL control is rotated.

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

f. Set the A TRIGGER SLOPE button to Negative (button in).

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

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

4. Check Single Sweep Operation

a. Set the **A** & B SOURCE switch to VERT MODE.

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

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

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

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

f. CHECK – RESET/READY LED goes out and a single sweep occurs.

NOTE

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

g. Press in the SGL SWP button several times.

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

i. Disconnect the test equipment from the instrument.

EXTERNAL Z-AXIS AND CALIBRATOR

Equipment Required (See Table 4-1):

- Leveled Sine-Wave Generator
- Two 50-Ω BNC Coaxial Cables
- 50-Ω BNC Termination
- BNC T-Connector
- 10X Probe (provided with instrument)

INITIAL CONTROL SETTINGS

Vertical

Channel 1 POSITION	Midrange
MODE	CH 1
BW LIMIT	On (button in)
CH 1 VOLTS/DIV	1 V
CH 1 VOLTS/DIV Variable	CAL detent
Input Coupling	DC

Horizontal

POSITION	Midrange
MODE	A
A SEC/DIV	10 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)

A TRIGGER

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

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 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 Calibrator Amplitude and Frequency

a. Set:

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

b. Connect the 10X Probe to the CH 1 OR X input connector and connect the probe tip to the CAL connector.

c. Center the vertical display and, if necessary, adjust the probe compensation for a flat top square-wave display.

d. CHECK – For a 5-division display.

e. CHECK – For a 5-division period (5-divisions between risetime portions of the display).

f. Disconnect the 10X 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 so 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 replace 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.

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

REPAIRS MADE	INTERNAL ADJUSTMENTS AFFECTED																				
	-8.6 VOLTS	GRID BIAS, ASTIG, AND GEOM	ATTENUATOR STEP BALANCE	2/5 mV DC BALANCE	CH 1 VAR AND CH 2 INVERT BALANCES	MF/LF COMP AND GAIN BALANCE	CH 1 AND CH 2 GAINS	ATTENUATOR COMPENSATION	HF COMP AND CH 2 HF COMP	2 mV PEAKING	HORIZONTAL GAIN	X10 GAIN	MAGNIFIER REGISTRATION	HIGH SPEED AND 5 nS TIMING	DELAY TIME	X GAIN	INTERNAL AND EXTERNAL TRIGGER OFFSETS	A AND B TRIGGER SENSITIVITY	SLOPE BALANCE	P-P AUTO	CALIBRATOR
POWER SUPPLIES	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨	▨
VERTICAL ATTENUATORS			▨	▨	▨	▨	▨	▨	▨	▨											▨
PREAMPS & CHANNEL SW			▨	▨	▨	▨	▨	▨	▨	▨											▨
VERTICAL OUTPUT					▨	▨	▨	▨	▨	▨											▨
TRIGGER CIRCUITS																	▨	▨	▨	▨	
A SWEEP GENERATOR											▨	▨	▨	▨	▨						▨
B SWEEP GENERATOR														▨							
HORIZONTAL AMPLIFIER											▨	▨	▨	▨	▨	▨					▨
CRT		▨					▨		▨		▨	▨	▨			▨		▨			▨

INDEX TO ADJUSTMENT PROCEDURE STEPS

Power Supply and CRT Display

Vertical

Horizontal

Trigger

Calibrator

POWER SUPPLY AND CRT DISPLAY

Equipment Required (See Table 4-1):

Leveled Sine-Wave Generator	Digital Voltmeter
Time-Mark Generator	DC Voltmeter
50-Ω BNC Coaxial Cable	Alignment Tool
50-Ω BNC Termination	

See **ADJUSTMENT LOCATIONS 1**

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

INITIAL CONTROL SETTINGS

Vertical (Both Channels)

POSITION	Midrange
MODE	CH 1
VOLTS/DIV	5 mV
VOLTS/DIV Variable	CAL detent
Input Coupling	GND

Horizontal

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

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM

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 Adjust potentiometer (R938) for a voltmeter reading of -8.6 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	W961	-8.56 to -8.64
+5.2 V	W968	+5.04 to +5.35
+8.6 V	W960	+8.43 to +8.77
+30 V	W956	+29.1 to +30.9
+102 V	W954	+99 to +105

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 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 A INTENSITY control fully counterclockwise.

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

e. Disconnect the 50-Ω termination from the EXT Z AXIS INPUT connector.

4. Adjust Astigmatism (R874)

a. Set:

A INTENSITY	Visible display
CH 1 VOLTS/DIV	5 mV
Channel 1 Input Coupling	DC
A 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 input connector.

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

d. ADJUST – Astig (R874) and the FOCUS control for the best defined waveform.

e. Disconnect the test equipment from the instrument.

5. Adjust Trace Alignment

a. Position the trace to the center horizontal graticule line.

b. ADJUST – The 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
A SEC/DIV	0.1 ms

b. Connect 50-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 to position the baseline part of the display below the bottom horizontal graticule line.

d. Adjust the SEC/DIV Variable control for 5 markers per division.

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

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

g. 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.

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

i. Repeat parts e through h for optimum compromise between the vertical and horizontal displays.

j. Disconnect the test equipment from the instrument.

7. Check Scale Illumination

a. Rotate the SCALE ILLUM control between the maximum counterclockwise position and the maximum clockwise position.

b. CHECK – The scale illumination lights are off in the maximum counterclockwise position. The brightness of the scale illumination lights increases as the SCALE ILLUM control is rotated to the maximum clockwise position.

VERTICAL

Equipment Required (See Table 4-1):

Calibration Generator	Dual-Input Coupler
Leveled Sine-Wave Generator	10X Attenuator
50-Ω BNC Coaxial Cable	Adapter
50-Ω BNC Precision Coaxial Cable	Alignment Tool
50-Ω BNC Termination	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
MODE	CH 1
BW LIMIT	Off (button out)
INVERT	Off (knob in)
VOLTS/DIV	50 mV
VOLTS/DIV Variable	CAL detent
Input Coupling	AC

Horizontal

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

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	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. Set the CH 1 VOLTS/DIV switch to 5 mV.

c. ADJUST—CH 1 Step Atten Bal (R10) to set the trace on the center horizontal graticule line.

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

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

f. Set the Vertical MODE switch to CH 2.

g. Repeat parts a through e for Channel 2, adjusting Ch 2 Step Atten Bal (R60) in part c.

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 CH1 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—CH1 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.

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

4. Adjust Channel 2 Invert Balance (R75)

a. Set the Vertical MODE switch to CH 2.

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

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

d. ADJUST—CH2 Invert Bal (R75) to set the trace to the center horizontal graticule line.

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

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

NOTE

If the trace shift is less then 1 division when rotating CH 2 VOLTS/DIV Variable control between its clockwise and counterclockwise positions, proceed to step j, otherwise proceed to step g.

g. Readjust CH 2 Invert Bal (R75) slightly so that the trace shift is less than one division as the CH 2 VOLTS/DIV Variable control is rotated between fully clockwise and counterclockwise positions.

h. Set the CH 2 VOLTS/DIV Variable control to the CAL detent.

i. CHECK—The trace shift is less that 1.5 divisions when the INVERT switch is set from Off (button out) to ON (button in).

j. Repeat parts b through i until the trace shift requirements for both INVERT and CH 2 VOLTS/DIV Variable are met.

k. Rotate the CH 2 VOLTS/DIV Variable control clockwise to the CAL detent, and set the INVERT button to OFF (button out).

l. INTERACTION—Repeat steps 2 and 4 for CH 2 until no further improvement is noted.

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

a. Set:

INVERT	Off (button out)
Vertical MODE	CH 2
VOLTS/DIV (both)	10 mV
Input Coupling (both)	DC
A 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 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—CH2 MF/LF Comp (C53) and CH2 MF/LF Gain Bal (R97) for the best front corner and flat top.

f. Move the cable from the CH 2 input connector to the CH 1 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—CH1 MF/LF Comp (C3) and CH1 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 input connector.

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

c. ADJUST—CH1 Gain (R145) for an exact 5-division display.

d. Move the cable from the CH 1 input connector to the CH 2 input connector. Set the Vertical MODE switch to CH 2.

e. ADJUST—CH2 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—Ch2 2mV 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—Ch1 2mV 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.

c. Move the cable from the CH 1 input connector to the CH 2 input connector. Set the Vertical MODE switch to CH 2.

d. Repeat part b using the Channel 2 controls.

e. Disconnect the test equipment from the instrument.

Table 5-3
Deflection Accuracy Limits

VOLTS/DIV Switch Setting	Standard Amplitude Signal	Vertical Deflection (Divisions)	Accuracy Limits (Divisions)
2 mV	10 mV	5	4.90 to 5.10
5 mV	20 mV	4	3.92 to 4.08
10 mV	50 mV	5	4.90 to 5.10
20 mV	0.1 V	5	4.90 to 5.10
50 mV	0.2 V	4	3.92 to 4.08
0.1 V	0.5 V	5	4.90 to 5.10
0.2 V	1 V	5	4.90 to 5.10
0.5 V	2 V	4	3.92 to 4.08
1 V	5 V	5	4.90 to 5.10
2 V	10 V	5	4.90 to 5.10
5 V	20 V	4	3.92 to 4.08

8. Adjust Attenuator Compensation (C7, C12, C11, C5, C4, C62, C61, C55, C54, and C57)

a. Set:

Vertical MODE	CH 1
Input Coupling (both)	DC

b. Connect the high-amplitude square wave output via a 50-Ω termination, a probe-tip-to-BNC adapter, and the 10X probe to the CH 1 OR X input connector.

c. Set the generator to produce a 1-kHz, 5-division display and compensate the probe using the probe compensation adjustment (see the probe instruction manual).

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

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

NOTE

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

Table 5-4
Attenuator Compensation Adjustments

VOLTS/DIV	Adjustment	Channel 1	Channel 2
10 mV	Input C	C7	C57
0.1 V	LF Comp	C12	C62
	Input C	C11	C61
1 V	LF Comp	C5	C55
	Input C	C4	C54

f. ADJUST—The Ch1 1X Attn (C7) capacitor for best front corner.

g. Set the CH 1 VOLTS/DIV switch to 0.1 V.

h. Replace the probe and probe-tip-to-BNC adapter with a 50-Ω cable.

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

j. ADJUST—The Ch1 10X Attn (C12) for best front corner.

k. Replace the 50-Ω cable and the 50-Ω termination with the probe and probe-tip-to-BNC adapter.

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

m. ADJUST—The Ch1 10X Attn (C11) for best flat top.

n. Repeat parts h through m until no further improvement is noted.

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

p. Replace the probe and probe-tip-to-BNC adapter with the 50-Ω cable and 50-Ω termination.

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

r. ADJUST—The Ch1 100X Attn (C5) for best front corner.

s. Replace the 50-Ω cable and 50-Ω termination with the probe and probe-tip-to-BNC adapter.

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

u. ADJUST—The 100X Attn (C4) for best flat top.

v. Repeat parts p through u until no further improvement is noted.

w. Set the Vertical MODE switch to CH 2.

x. Repeat parts b through v for Channel 2.

y. Disconnect the test equipment from the instrument.

9. Adjust High-Frequency Compensation (C237), Delay Line Compensation (R240 and R241), and Channel 2 High-Frequency Compensation (C180)

a. Set:

Vertical MODE	CH 1
BW LIMIT	Off (button out)
VOLTS/DIV (both)	10 mV
Input Coupling (both)	DC
A SEC/DIV	0.05 μs
A & B SOURCE	VERT MODE

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 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 Comp (C237) for the best front corner with minimum overshoot on the displayed signal.

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

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

h. Move the cable from the CH 1 input connector to the CH 2 input connector and reconnect the 10X attenuator. Set the Vertical MODE switch to CH 2.

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

j. Set the top of the display to the center horizontal graticule line using the Channel 2 POSITION control.

k. ADJUST—Ch2 HF Comp (C180) for the best front corner with minimum overshoot on the displayed signal.

10. Adjust 2-mV Peaking Compensation (C76 and C26)

a. Set both VOLTS/DIV switches to 2 mV.

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

c. Set the top of the display to the center horizontal graticule line using the Channel 2 POSITION control.

d. ADJUST—Ch2 2mV Peak Comp (C76) for the best front corner with minimum overshoot of the displayed signal.

e. 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.

f. Repeat parts b through d for Channel 1, adjusting Ch1 2mV Peak Comp (C26) in part d.

g. 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.

11. Check Bandwidth

a. Set:

Vertical POSITION (both)	Midrange
BW LIMIT	Off (button out)
VOLTS/DIV (both)	2 mV
VOLTS/DIV Variable (both)	CAL detent
Input Coupling (both)	DC
A SEC/DIV	20 μs

b. Connect the leveled sine-wave generator output via a 50-Ω precision cable and a 50-Ω termination to the CH 2 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 5-5 for the corresponding VOLTS/DIV switch setting.

Table 5-5
Settings for Bandwidth Checks

VOLTS/DIV Switch Setting	Generator Output Frequency
2 mV	90 MHz
5 mV to 5 V	100 MHz

e. 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.

f. Move the cable from the CH 1 input connector to the CH 2 input connector. Set the Vertical MODE switch to CH 2.

g. 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.

h. Disconnect the test equipment from the instrument.

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	50-Ω BNC Termination
Leveled Sine-Wave Generator	Dual-Input Coupler
Time-Mark Generator	Test Oscilloscope
50-Ω Coaxial Cable	Alignment Tool

See **ADJUSTMENT LOCATIONS 1**, **ADJUSTMENT LOCATIONS 2**, and **ADJUSTMENT LOCATIONS 3**

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

INITIAL CONTROL SETTINGS

Vertical

POSITION	Midrange
MODE	CH 1
BW LIMIT	Off (button out)
INVERT	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
MODE	A
A and B SEC/DIV	0.1 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise

B TRIGGER

SLOPE	Positive (button out)
LEVEL	RUNS AFTER DLY (fully clockwise)

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	NORM
A COUPL	NORM
A EXT COUPL	DC

PROCEDURE STEPS

1. Adjust Horizontal Amplifier Gain (R740 and R730)

a. Connect 0.1-ms time markers from the time-mark generator via a 50-Ω cable and a 50-Ω termination to the CH 1 input connector.

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

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

NOTE

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

d. Set the Horizontal MODE switch to B.

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

2. Adjust X10 Horizontal Amplifier Gain (R754)

a. Set:

Horizontal MODE	A
X10 Magnifier	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 (R754) for 1 time marker per division.

3. Adjust Magnifier Registration (R749)

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

b. Select 1-ms time markers from the time-mark generator.

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

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

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

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

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

4. Adjust Delay Dial Timing (R646 and R652)

a. Set:

Horizontal MODE	ALT
A SEC/DIV	0.1 ms
B SEC/DIV	10 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	1.00

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

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

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

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

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

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

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

5. Adjust 5 μs Timing (C703 and C713)

a. Set:

Horizontal MODE	A
A SEC/DIV	5 μs

b. Select 5-μs time markers from the time-mark generator.

c. ADJUST – A Sweep 5-μs Timing (C703) for 1 time marker per division over the center 8 divisions.

d. Set:

Horizontal MODE	B
A SEC/DIV	10 μs
B SEC/DIV	5 μs

e. ADJUST – B Sweep 5-μs Timing (C713) for 1 time marker per division over the center 8 divisions.

6. Adjust 5-ns Timing and Linearity (C774)

a. Set:

CH 1 VOLTS/DIV	0.2 V
Horizontal MODE	A
A SEC/DIV	0.05 μs
A & B SOURCE	A EXT

b. Connect a 50-Ω cable and a 50-Ω termination to the EXT INPUT connector from the time-mark generator.

c. Select 5-ns time markers from the time-mark generator and set the start of the display on the 1st vertical graticule line.

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

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

f. ADJUST—5-ns Timing (C774) for one time marker per division over the center 8 divisions of the magnified sweep.

g. CHECK—Time markers between the 2nd and 4th vertical graticule lines should be aligned within 0.05 division. If not, a slight compromise between timing and linearity should be made by readjusting the 5-ns Timing capacitor (C774).

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

i. Set the A SEC/DIV switch to 0.1 μs.

j. CHECK—Timing accuracy is within 2% (0.16 division at the 10th vertical graticule line). If not, a slight compromise between the 5-ns timing and the 20-ns timing should be made by readjusting the 5-ns Timing capacitor (C774).

k. Disconnect the 50-Ω cable and the 50-Ω termination from the EXT INPUT connector to the time-mark generator.

7. Check Timing Accuracy and Linearity

a. Set:

CH 1 VOLTS/DIV	0.5 V
A SEC/DIV	0.05 μs
X10 Magnifier	Off (knob in)
A TRIGGER Mode	NORM
A & B SOURCE	VERT MODE

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

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

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

e. CHECK—Timing accuracy is within 2% (0.16 division at the 10th vertical graticule line), and linearity is within 5% (0.1 division over any 2 of the center 8 divisions).

NOTE

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

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

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

h. Select 50-ms time markers from the time-mark generator when checking the A Sweep and 5-ms time markers when checking the B Sweep.

Table 5-6

Settings for Timing Accuracy Checks

SEC/DIV Switch Setting	Time-Mark Generator Setting	
	Normal (X1)	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
A Sweep Only		
0.1 s	0.1 s	10 ms
0.2 s	0.2 s	20 ms
0.5 s	0.5 s	50 ms

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 3% (0.24 division at the 10th vertical graticule line), and linearity is within 5% (0.1 division over any 2 of the center 8 divisions). Exclude any portion of the sweep past the 100th magnified division.

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

l. Set:

Horizontal MODE	B
A SEC/DIV	0.1 μs
B SEC/DIV	0.05 μs
X10 Magnifier	Off (knob in)

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

8. Check Delay Time Dial Range and Accuracy

a. Set:

Channel 1 Input Coupling	GND
Horizontal MODE	ALT
A and B SEC/DIV	0.1 ms
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise
A TRIGGER Mode	P-P AUTO

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

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

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

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

f. Set:

A and B SEC/DIV	0.5 μs
B DELAY TIME POSITION	Fully counter-clockwise

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

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

i. Repeat parts d and e.

j. Set:

Channel 1 Input Coupling	DC
Horizontal MODE	B
A SEC/DIV	0.5 μs
B SEC/DIV	0.05 μs
B DELAY TIME POSITION	1.00

k. Select 0.5-μs time markers from the time-mark generator.

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

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

n. CHECK—The B DELAY TIME POSITION dial setting is between 8.910 and 9.090.

o. Repeat parts l through n for the remaining A and B SEC/DIV and time-mark generator setting combinations shown in Table 5-7.

p. Set:

A SEC/DIV	5 μs
B SEC/DIV	0.5 μs
B DELAY TIME POSITION	1.00

Table 5-7
Settings for Delay Time Accuracy Checks

A SEC/DIV Switch Setting	B SEC/DIV Switch Setting	Time-Mark Generator Setting
0.5 μs	0.05 μs	0.5 μs
5 μs	0.5 μs	5 μs
0.5 ms	50 μs	0.5 μs
5 ms	0.5 ms	5 ms
0.5 s	50 ms	0.5 s

q. Select 5-μs time markers from the time-mark generator.

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

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

t. CHECK—The B DELAY TIME POSITION dial setting is 0.980 to 1.020 greater than the previous setting.

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

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

w. Disconnect the test equipment from the instrument.

9. Adjust X Gain (R760)

a. Set:

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

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

c. ADJUST—X Gain (R760) for exactly 5-divisions of horizontal deflection.

d. Disconnect the test equipment from the instrument.

10. Check A-Sweep Holdoff

a. Set:

Horizontal MODE	A
A SEC/DIV	1 ms
VAR HOLDOFF	NORM

b. Connect the test oscilloscope and its 10X probe tip to the front end of R707 (toward the front panel) which is located on the Timing circuit board.

c. CHECK—The A-Sweep holdoff is greater than 3 ms but less than 7 ms.

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

e. CHECK—The A-Sweep holdoff has increased by a factor of 10 or more.

f. Disconnect the test oscilloscope 10X probe from R707.

TRIGGER

Equipment Required (See Table 4-1):

- Leveled Sine-Wave Generator
- 50-Ω BNC Coaxial Cable
- 50-Ω BNC Termination
- 10X Attenuator
- Alignment Tool

See **ADJUSTMENT LOCATIONS 1**

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

INITIAL CONTROL SETTINGS

Vertical (Both Channels)

POSITION	Midrange
MODE	BOTH-ALT
BW LIMIT	Off (button out)
INVERT	Off (button out)
VOLTS/DIV	50 mV
VOLTS/DIV Variable	CAL detent
Input Coupling	GND

Horizontal

POSITION	Midrange
MODE	A
A and B SEC/DIV	20 μs
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	Fully counter-clockwise

B TRIGGER

SLOPE	Positive (button out)
LEVEL	Midrange

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM
A EXT COUPL	DC

PROCEDURE STEPS

1. Adjust Internal and External Trigger Offset (R309 and R387))

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. Set both Input Coupling switches to DC.

c. Connect the leveled sine-wave generator output via a 50-Ω cable, 10X attenuator, and a 50-Ω termination to the BNC female connector of the dual-input coupler. Connect the two BNC male connectors of the dual-input coupler to the CH 1 and CH 2 connectors.

d. Set the generator to produce a 50 kHz, 4-division display on both channels.

e. Rotate the A TRIGGER LEVEL control to the midrange position (equal distance between the + and - positions).

f. Vertically center both displays with the Vertical POSITION controls and horizontally position the start of the displays on the 2nd vertical graticule line.

g. ADJUST – The Trigger Offset (R309) so that both displays are superimposed and start at the center horizontal graticule line.

h. Disconnect the dual-input coupler from the CH 2 input connector and connect it to the EXT INPUT connector.

i. Set the generator to produce a 8-division display.

j. Set the A & B SOURCE switch to A EXT position.

k. ADJUST—Ext Off (R387) so that the display triggers (start of the display) at the center horizontal graticule line.

l. Disconnect the test equipment from the instrument.

2. Adjust Trigger Sensitivity (R479 and R627)

a. Set:

Vertical MODE	CH 1
CH 1 VOLTS/DIV	0.1 V
Input Coupling (both)	AC
A SEC/DIV	10 μs

b. Connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 1 input connector.

c. Set the generator to produce a 50-kHz, 2.4-division display.

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

e. ADJUST—The A Trig Sens (R479) while rotating the A TRIGGER LEVEL control slowly so that the A Trigger is just able to be maintained.

f. Set the Horizontal MODE switch to B.

g. ADJUST—B Trig Sens (R627) while rotating the B TRIGGER LEVEL control slowly so that the B Trigger is just able to be maintained.

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

a. Set:

CH 1 VOLTS/DIV	10 mV
Horizontal MODE	A
A TRIGGER SLOPE	OUT
A TRIGGER LEVEL	Fully clockwise

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

c. Set the CH 1 VOLTS/DIV switch to 0.1 V.

d. ADJUST—(+) Auto (R434) so that the vertical display just solidly triggers on the positive peak of the signal.

e. Set:

A TRIGGER SLOPE	IN
A TRIGGER LEVEL	Fully counter-clockwise

f. ADJUST—(-) Auto (R435) so that the display just solidly triggers on the negative peak of the signal.

g. Disconnect the test equipment from the instrument.

CALIBRATOR

Equipment Required (See Table 4-1):

- Calibration Generator
- Time-Mark Generator
- 50-Ω BNC Coaxial Cables
- 50-Ω BNC Termination
- 10X Probe (provided with instrument)

See **ADJUSTMENT LOCATIONS 1**

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

INITIAL CONTROL SETTINGS

Vertical

Channel 1 POSITION	Midrange
MODE	CH 1
BW LIMIT	On (button in)
CH 1 VOLTS/DIV	0.1 V
CH 1 VOLTS/DIV Variable	CAL detent
Channel 1 Input Coupling	DC

Horizontal

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

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	OUT
LEVEL	Midrange
A TRIG BW	FULL
A SOURCE	INT

PROCEDURE STEPS

1. Adjust Calibrator Amplitude and Frequency (R984 and R990)

a. Connect the standard amplitude generator output via a probe-tip-to-BNC adapter, and a properly adjusted 10X probe (supplied with the instrument) to the CH 1 connector.

b. Set the standard amplitude generator output to 0.5 V.

c. Adjust the CH 1 VOLTS/DIV Variable control for a waveform amplitude of exactly 8 divisions.

d. Disconnect the probe tip from the standard amplitude generator and connect it to the CAL connector.

e. ADJUST – Cal Gain (R984) for a display amplitude of exactly 8 divisions.

f. Return the CH 1 VOLTS/DIV Variable control to the CAL detent and set CH 1 VOLTS/DIV to 0.1 V (using the 10X PROBE scale factor).

g. ADJUST – Cal Freq (R990) for an exact 5 division period (5 divisions between risetime portions of the display).

NOTE

Greater accuracy of the CAL output frequency can be achieved by comparing the square-wave period to the time markers.

h. Set:

CH 2 VOLTS/DIV	0.5 V
Vertical MODE	BOTH, ALT
A & B SOURCE	CH 1

i. Connect the time-mark generator output to the CH 2 input connector via a 50-ohm cable and a 50-Ω terminator.

j. Set the generator to produce 1-ms time markers.

k. ADJUST – Cal Freq (R990) for the least amount of drift of the displayed time markers.

l. Disconnect the 10X probe and test equipment from the instrument.

MAINTENANCE

This section contains information for conducting preventive maintenance, troubleshooting, and corrective maintenance on the instrument. Circuit board removal procedures are included in the corrective maintenance part of this section.

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.
7. Do not slide the components over any surface.

Table 6-1
Relative 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
JFET	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 resistance of 100 Ω):**

1 = 100 to 500 V
2 = 200 to 500 V
3 = 250 V
4 = 500 V
5 = 400 to 600 V
6 = 600 to 800 V
7 = 400 to 1000 V (est)
8 = 900 V
9 = 1200 V

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, and checking instrument performance. When performed 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 front cover supplied with the instrument provides both dust and damage protection for the front panel and crt. The front cover should be on 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 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 portions 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.

Table 6-2
External Inspection Checklist

Item	Inspect For	Repair Action
Cabinet, Front Panel, and Cover	Cracks, scratches, deformations, and damaged hardware or gaskets.	Touch up paint scratches and replace defective components.
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.

CLEANING. Loose dust on the outside of the instrument can be removed with a soft cloth or small soft-bristle brush. The brush is particularly useful for dislodging dirt on and around the controls and connectors. Dirt that remains can be removed with a soft cloth dampened in a mild detergent-and-water solution. Do not use abrasive cleaners. Clean the light filter and the crt face with a soft lint-free cloth dampened with isopropyl alcohol, denatured ethyl 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 important that the cause of overheating be corrected to prevent recurrence of the damage.

If any electrical component is replaced, conduct a Performance Check for the affected circuit and for other closely related circuits (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).

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.
Semiconductors	Loosely inserted in sockets. Distorted pins.	Firmly seat loose semiconductors. Remove devices having distorted pins. Carefully straighten pins (as required to fit the socket) using long-nose pliers, and reinsert firmly. Ensure that straightening action does not crack pins, causing them to break.
Wiring and Cables	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.

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 by removing easily accessible shields and panels (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 SEC/DIV switches are mounted on 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 required, use this procedure.

1. The VOLTS/DIV switches contain cam-actuated switches.

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 on the switches or attenuators.

The only recommended circuit coolants for the VOLT/DIV attenuators are dry ice (CO_2) and isopropyl alcohol.

   a. Use only isopropyl alcohol as a cleaning agent for switches, especially in the area of the Vertical Attenuator circuit board. Carbon based solvents will damage the board material.

   b. Apply the alcohol with a small, camel-hair brush. Do not use cotton-tipped applicators, since the cotton tends to snag and possibly damage the switch contacts.

2. The SEC/DIV switch is comprised of rotary-activated contacts.

CAUTION

Use only deionized or distilled water at about 55°C (131°F) to clean the SEC/DIV timing switch. Tap water contains impurities that remain as residual deposits after evaporation.

   a. Spray hot water into the slots at the top of each switch housing while rotating the switch control knob. Use an atomizing spray device, and spray for only about five seconds.

   b. Dry the switch and circuit board on which it is mounted with dry, low-pressure air.

   c. Bake the switch and circuit board in an oven or drying compartment using dry circulating air at about 75°C (167°F) for 15 minutes to eliminate all moisture.

   d. Spray a very small amount (only about a 1/2 second squirt) of a recommended lubricant, such as No Noise, into the slots at the top of the switch housing.

   e. Rotate the switch control knob about 180° and again spray a very small amount of lubricant into each slot.

LUBRICATION

Most of the potentiometers used in this instrument are permanently sealed and generally do not require periodic lubrication. All switches, both rotary- and lever-type, are installed with proper lubrication applied where necessary and will rarely require any additional lubrication. 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 semiconductor performance is actual operation in the instrument.

PERIODIC READJUSTMENT

To ensure accurate measurements, check the performance of this instrument 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 troubles 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 interaction 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 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. Portions of circuitry mounted on each circuit board are enclosed by heavy black lines. The assembly number and name of the circuit are shown near either the top or the bottom edge of the enclosed area.

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 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 is found in the Diagrams section on the back of a foldout page, preceding the first 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 illustration aids in troubleshooting by showing the connection pads for the components mounted on the top side of the circuit board. By using this illustration, circuit tracing and probing for voltages and signals that are inaccessible from the top side of the board may be achieved without dismantling 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 Interconnections

A circuit board interconnection diagram is provided in the Diagrams section to aid in tracing a signal path or power source between boards. All wire, plug, and jack numbers are shown along with their associated wire or pin numbers.

Power Distribution

Power Distribution diagram 11 is provided to aid in troubleshooting power-supply problems. This diagram shows the service jumper connections used to remove power from the various circuit boards. Excessive loading on a power supply by a circuit board fault may be isolated by disconnecting the 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 diagram lists the grid coordinates of each component shown on that diagram. To aid in physically locating components on the circuit board, this table also lists the circuit-board grid coordinates of each component.

Adjacent to each circuit board illustration is an alpha-numeric listing of all components mounted on that board. The second column in each 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 on 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 usually color coded with the EIA color code; however, some metal-film type resistors may have the value printed on the body. The color code is interpreted starting with the stripe nearest to one end of the resistor. Composition resistors have four stripes; these represent two significant digits, a multiplier, and a tolerance value. Metal-film resistors have five stripes representing three significant digits, 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 coded 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 when replacing them.

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 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. The cathode and anode ends of a metal-encased diode may 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 used at completion of the instrument design. 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 shown in Figure 9-2, examine the associated circuitry or consult the semiconductor manufacturer's data sheet.

Multipin Connectors

Multipin connector orientation is indexed 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 index on the holder is aligned with the index on the circuit board (see Figure 6-1).

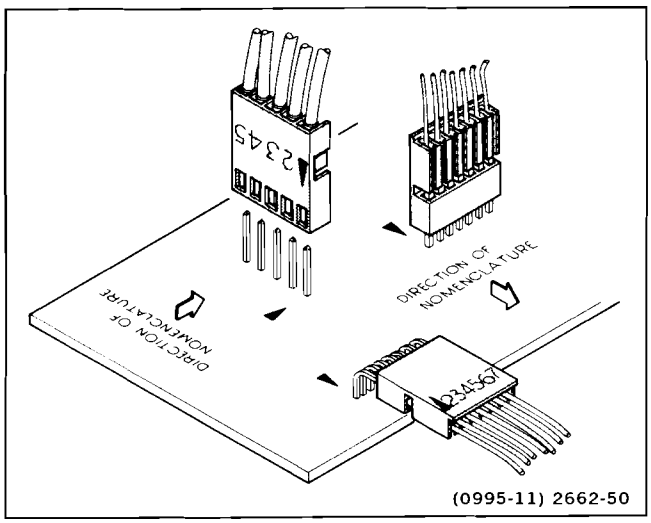


Figure 6-1. Multi-connector holder orientation.

TROUBLESHOOTING EQUIPMENT

The equipment listed in Table 4-1 of this manual, 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 steps 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.

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 the Operating Instructions in Section 2 of this manual.

2. Check Associated Equipment

Before proceeding, ensure that any equipment used with the 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 to the cause of an instrument malfunction.

4. Check Instrument Performance and Adjustment

Check the performance of either those circuits where trouble appears to exist or the entire instrument. The apparent trouble may 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 trouble shooting is done in the Preregulator and Inverter Power Supply sections of the instrument.

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 (see Table 6-4 and associated circuit board illustration). Voltages may be measured with a DMM, while the ripple measurements are accomplished only with an oscilloscope. Before checking power-supply circuitry, set the A INTENSITY control to minimum brightness and the A SEC/DIV switch to X-Y mode.

When measuring ripple, use a 1X probe having a bayonet ground assembly attached to the probe tip to minimize stray pickup. Insert the bayonet assembly signal tip into the first test point indicated in Table 6-4, and touch the bayonet assembly ground tip to the nearest chassis ground. 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).

Table 6-4
Power Supply Limits and Ripple

Power Supply	Test Point	Reading (Volts)	P-P Ripple (mV)
-8.6 V	W961	-8.56 to -8.64	<1.5
+5.2 V	W968	+5.04 to +5.35	<3
+8.6 V	W960	+8.43 to +8.77	<1.5
+30 V	W956	+29.1 to +30.9	<25
+102 V	W954	+99.0 to +105.0	<40

If the power-supply voltages and ripple are within the ranges listed in Table 6-4, the supply can be assumed to be working correctly. If they are outside the 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.

7. Check Circuit Board Interconnections

After the trouble has been isolated to a particular circuit, again check for loose or broken connections, improperly seated semiconductors, 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 the 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 ac power 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 the surrounding circuitry. See Figure 9-1 for component value identification and Figure 9-2 for typical semiconductor lead configurations.

CAUTION

When checking semiconductors, observe the static-sensitivity precautions located at the beginning of this section.

TRANSISTORS. A good check of a transistor 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-type transistor checker for testing. 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 V 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 open, no voltage will be developed across the resistors 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 may 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 much lower when the meter leads are reversed.

When troubleshooting a field-effect transistor (FET), 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 when 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 may damage a diode. Checks on diodes can be performed in much the same manner as those 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 much lower when the meter leads are reversed.

Silicon diodes should have 0.6 V to 0.8 V across their junctions when conducting; Schottky diodes about 0.2 V to 0.4 V. 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 of that circuit and any other closely related circuit should be checked. Since the power supplies affect all circuits, performance of the entire instrument should be checked if work has been done on 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 of this manual 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 Instrument Repackaging in Section 2.

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 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 the 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-Manufacturer's 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 all modification and option numbers).
2. Instrument serial number.
3. A description of the part (if electrical, include its full circuit 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 products may be substituted for the examples given, provided their characteristics are similar.

Table 6-5
Maintenance Aids

Description	Specifications	Usage	Example
1. Soldering Iron	15 to 25 W.	General soldering and unsoldering.	Antex Precision Model C.
2. Torx Screwdriver Tips and Handles	Torx tips #T7, #T9, #T10, #T15 and #T20.	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. Torx 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.	
5. Hex Wrenches	0.050 inch and 1/16 inch.	Assembly and disassembly.	Allen Wrenches.
6. Long-nose Pliers		Component removal and replacement.	Diamalloy Model LN 55-3.
7. Diagonal Cutters		Component removal and replacement.	Diamalloy Model M554-3.
8. Vacuum Solder Extractor	No static charge retention.	Unsoldering components.	Pace Model PC-10.
9. Lubricant	No-Noise.	Switch lubrication.	Tektronix Part Number 006-0442-02.
10. Pin-replacement Kit		Replace circuit board connector pins.	Tektronix Part Number 040-0542-01.
11. Isolation Transformer		Isolate the instrument from the ac-power-source outlet.	Tektronix Part Number 006-5953-00.
12. 1X Probe		Power supply ripple check.	TEKTRONIX P6101A Probe (1X).
13. Bayonet Ground Assembly		Signal interconnection.	Tektronix Part Number 013-0085-00.
14. IC Test Clip	40-lead tester.	Testing DIP IC packages.	Tektronix Part Number 003-0801-00.
15. IC-Removal Tool		Removing DIP IC packages.	Augat T114-1.
16. IC Test Clip	Reagent grade.	Cleaning attenuator and front panel assemblies.	2-Isopropanol.

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 a multipin connector, an index 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.

TRANSISTORS AND INTEGRATED CIRCUITS

Transistors and integrated circuits should not be replaced unless they are actually defective. If removed from their sockets or 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 circuit that may be affected.

Any replacement component 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 10-2 for typical lead-configuration illustrations.

To remove socketed dual-in-line packaged (DIP) integrated circuits, pull slowly and evenly on both ends of the device. Avoid disengaging one end of the integrated circuit from the socket before the other, since this may damage the pins.

To remove a soldered DIP IC when it is going to be replaced, clip all the leads of the device and remove the leads from the circuit board one at a time. If the device must be removed intact for possible reinstallation, 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 chassis 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 circuits boards or small insulated wires, use only a 15-watt to 25-watt, pencil-type soldering iron. A higher wattage soldering iron may 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. 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 so may damage the board.

NOTE

Some components are difficult to remove from the circuit board due to a bend placed in the component leads during machine insertion. The bent leads 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 flat-bladed 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 the 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. Bend the leads of the replacement component 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 the correct length 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 source before removing or replacing any component or assembly.

Cabinet

To remove the instrument cabinet, perform the following steps:

1. If present, remove the power-cord clamp and securing screw from the rear panel.

2. Disconnect the power cord from the instrument.

3. Remove the screws from the right-rear side, the bottom front of the cabinet, and two screws from the rear panel. Then remove the rear panel.

4. Pull the front panel and attached chassis forward and out of the cabinet.

To reinstall the cabinet, perform the reverse of the preceding steps.

CAUTION

To ensure that the cabinet is grounded to the instrument chassis, the screw at the right rear side of the cabinet must be tightly secured.

Cathode-Ray Tube

Use care when handling a cathode ray tube (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, noting locations for reinstallation reference.

2. Unplug the Trace Rotation connector (P9006) from J9006 on the Front Panel circuit board noting location and orientation for reinstallation reference.

WARNING

The crt anode lead retains a high-voltage charge after the instrument is turned off. To avoid electrical shock, disconnect the crt anode lead from the High-Voltage Multiplier jack and ground it to the main instrument chassis.

3. Unplug the crt anode lead connector from the High-Voltage Multiplier jack located on the left front side of Power-Supply shield and discharge it to the chassis.

4. Remove the two front panel screws that fasten the plastic crt frame and a blue implosion shield to the front panel. Remove the crt frame and implosion shield from the instrument.

5. With the rear of the instrument facing you, place the fingers of both hands over the front edge of the front subpanel. 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.

6. Remove the crt socket cap from the rear of the crt socket for reinstallation.

To reinstall the crt, perform the reverse of the preceding steps. Before replacing the crt, 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. Ensure all pins are straight and that the indexing keys on the crt base socket and shield are aligned. Ensure that the ground clip makes contact only with the outside of the crt shield.

When pushing the crt base into the socket, verify that the crt base and socket are flush together as viewed from the rear. Ensure that the crt is seated properly in the front panel opening.

Scale Illum Circuit Board

To remove the Scale Illum circuit board, perform the following steps:

1. Disconnect the scale illum cable from J9882 on the Main circuit board. J9882 is located directly beneath the crt at the front edge of the Main board..

2. Remove the crt frame and implosion shield from the instrument (see step 4 Cathode-Ray Tube removal procedure).

3. Remove the screw holding the Scale Illum circuit board and Light Reflector to the chassis frame (located at the bottom of the crt).

4. Remove the Scale Illum circuit board and Light reflector from the instrument.

To reinstall the Scale Illum circuit board and Light Reflector, perform the reverse of the preceding steps.

Power-Supply Shields

To remove the power-supply shields, perform the following steps:

Top Shield

1. Remove the two screws at the front edge of the top shield.

2. Remove the screw that secures the right rear corner of the top shield to the rear of the chassis.

3. Lift the top shield out of the instrument.

To reinstall the top power-supply shield, perform the reverse of the preceding steps.

Side Shield

WARNING

The crt anode lead retains a high-voltage charge after the instrument is turned off. To avoid electric shock, disconnect the crt anode lead from the High-Voltage Multiplier jack and ground the lead to the main instrument chassis.

1. Unplug the crt anode lead from the High-Voltage Multiplier jack and discharge it to the chassis.

2. Remove the top shield as described in above procedure.

3. Remove the screw from the plastic power-supply shield on the bottom side of the Main circuit board.

4. Remove the screw located directly in front of the plastic power-supply shield (at the right side of the instrument).

5. Remove the two screws securing the side shield to the rear of the chassis. (The lower screw is located below the input power connector.)

6. Lift the power-supply side shield from the instrument.

To reinstall the power-supply side shield, perform the reverse of the preceding steps.

Lower Shield

1. Perform step 3 of the preceding Side Shield removal procedure.

2. Press inward gently on the rear of the plastic, lower shield on the bottom of the Main board. Slide the shield forward to clear the chassis edge, and remove it.

To reinstall the power-supply lower shield, perform the reverse of the preceding steps.

Filter Circuit Board

To remove the Filter circuit board, perform the following steps:

1. Remove the three Power-Supply shields (see the Power-Supply Shields removal procedure).

2. Remove the two screws that secure the Line Filter board to the rear chassis.

3. Lift the Line Filter assembly clear of adjacent components and remove the snap-on plastic cover.

4. Unsolder the following wires that connect the Line Filter board to the instrument:

   a. W9040 (gray-black-yellow) on the Main circuit board.

   b. W9190 (gray-brown-white) on the Main circuit board.

   c. The white-gray wire connected to RFI filter, FL9001.

   d. The gray-brown-black wire connected to the line fuseholder. (Move fuse cover completely off the fuseholder before unsoldering).

5. Lift the Line Filter circuit board out of the instrument.

To reinstall the Line Filter circuit board, perform the reverse of the preceding steps.

Alt Sweep Circuit Board

To remove the Alt Sweep circuit board, perform the following steps:

1. Unclip the Alt Sweep circuit board from the plastic holder attached to the Power-Supply shield.

2. Pull up and remove the Alt Sweep circuit board from the connectors on the Main circuit board.

To reinstall the Alt Sweep circuit board, perform the reverse of the preceding steps.

Attenuator Circuit Board

To remove the Attenuator circuit board, perform the following steps:

1. Use a 1/16-inch hexagonal 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 the two screws securing the Attenuator circuit board to the subpanel (located underneath the CH 1 and CH 2 input connectors).

5. Disconnect the following plugs from the Attenuator board, noting locations and orientations for reinstallation reference:

   a. P9200, a 4-wire connector located in the cutout at the rear edge of the top attenuator shield.

   b. P9991, a 4-wire connector located at the center rear edge of the board.

6. Disconnect the following plugs from the Main circuit board, noting locations and orientations for reinstallation reference:

   a. P9108, a 3-wire connector located between the crt and the power switch extension shaft (near the center of the board).

   b. P9103, a 3-wire connector located between the rear of the attenuator assembly and the crt.

7. Loosen the screw at the front edge of the top attenuator shield.

8. Remove the remaining six screws securing the top attenuator shield, noting screw lengths and locations for reinstallation reference.

9. Slide the top attenuator shield to the rear until it clears the screw at the front edge. Lift the shield out of the instrument.

10. Remove the screw in the left rear corner of the Attenuator board that secures the board to the bottom shield assembly.

11. Pull the Attenuator board straight back from the front of the instrument until the switch shafts are clear of the Front Panel board and the two Input Coupling switch shafts (located between the front panel and the subpanel). Lift the Attenuator board out of the instrument.

To reinstall the Attenuator circuit board, perform the reverse of the preceding steps.

Timing Circuit Board

To remove the Timing circuit board, perform the following steps.

1. Use a 1/16-inch hexagonal wrench to loosen the set-screw of the SEC/DIV Variable knob. Remove the Variable knob.

2. Lock the A and B SEC/DIV knobs together and note the position for reinstallation reference. Use a 1/16-inch hexagonal wrench to loosen the set screws securing the B SEC/DIV knob; pull off the knob.

3. Use a 1/16-inch Hex-key wrench to loosen two set screws securing the A SEC/DIV dial to the shaft assembly. Remove the dial.

4. Remove the following connectors from the Timing circuit board.

   a. P9705, an eight-wire connector located at the rear of the Timing circuit board.

   b. P9700, a 10-wire connector located on the right edge of the Timing circuit board.

   c. P9201, a 4-wire connector located at the left rear corner of the Timing board.

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

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

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

To reinstall the Timing circuit board, perform the reverse of the preceding steps.

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. Firmly grasp the FOCUS knob and pull straight out from the front panel. Remove the knob/extension shaft assembly from the instrument.

2. Remove the Alt Sweep circuit board (see Alt Sweep Circuit Board removal procedure).

3. Perform steps 1 through 6 under the Attenuator Circuit Board removal procedure.

4. Perform steps 1 through 4 under the Timing Circuit Board removal.

5. Place the instrument on its side. Remove three screws and one hexagonal post spacer holding the bottom shield to the main circuit board. Set instrument down.

6. Pull the bottom shield, along with the Attenuator and Timing circuit boards, straight back from the front of the instrument until 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.

7. If accessibility to the bottom of either the Attenuator or the Timing circuit board is desired refer to steps 7 through 10 of the Attenuator Circuit Board removal procedure or to steps 5 and 6 of the Timing Circuit Board removal procedure.

To reinstall the bottom shield, Attenuator, and Timing circuit board module assembly, perform the reverse of the preceding steps.

Front Panel Circuit Board

1. Remove the Bottom shield, Attenuator, and Timing circuit-board module (see the preceding removal procedure).

2. Remove the knobs from the following control shafts by pulling them straight out from the front panel:

   a. Channel 1 POSITION.

   b. A/B SWP SEP.

   c. Channel 2 POSITION.

   d. B TRIGGER LEVEL.

   e. A TRIGGER LEVEL.

   f. SCALE ILLUM.

3. Use a 1/16-inch hexagonal wrench to loosen the set screws and remove the following knobs:

   a. B INTENSITY.

   b. A INTENSITY.

   c. HORIZONTAL POSITION.

   d. VAR HOLDOFF.

4. Unsolder both the resistor to the EXT INPUT center connector and the wire strap to the EXT INPUT ground lug.

5. Disconnect the following plugs from the Main circuit board:

   a. P9884, a 2-wire connector located at the front edge of the board between the crt and power switch extension shaft.

   b. P2222, an 18-conductor flexible cable located at the front edge of the board.

   c. P2223, an 18-conductor flexible cable located at the front edge of the board.

6. Disconnect P9006, a 2-wire connector located at the upper left corner of the Front Panel board.

7. Remove the four screws that secure the Front Panel circuit board to the front subpanel.

8. Release the power indicator light-emitting diode (LED) from its holder.

9. Set all front-panel lever switches to their center positions.

10. Pull the Front Panel circuit board straight back until the switch shafts clear the front subpanel and lift it out of the instrument.

To reinstall the Front Panel circuit board, perform the reverse of the preceding steps.

Main Circuit Board

All components on the Main circuit board are accessible either directly or by removing 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. Remove the power-supply shields (see Power Supply Shields removal procedure).

2. Remove the Alt Sweep circuit board (see Alt Sweep Circuit Board removal procedure).

3. Disconnect the following connectors from the Main circuit board, noting locations and orientations for reinstallation reference:

   a. P9870B, a 4-wire connector (5-wire body) located at the left edge of the board in front of the delay line.

   b. P9108, a 4-wire connector located near the center of the board between the crt shield and the power-switch extension shaft.

   c. P9103, a 4-wire connector located between the left rear corner of the attenuator shield and the crt shield.

   d. P9884, a 2-wire connector located at the front edge of the board between the attenuator shield and the crt.

   e. P9644, a 3-wire connector located at the right edge of the board to the rear of the Timing circuit board.

   f. P9882, a 2-wire connector located at the front edge of the board, below the crt (accessible from the bottom side of the instrument).

4. Disconnect P9991, a 4-wire connector located at the center rear edge of the Attenuator circuit board.

5. Disconnect the following connectors from the Timing circuit board:

   a. P9705, an 8-wire connector located at the rear of the board.

   b. P9700, a 10-wire connector located at the right side of the board.

6. Disconnect the four deflection leads from the crt neckpins, noting locations and orientations for reinstallation reference.

7. Unsolder the delay-line wires from the Main circuit board, noting wire colors and locations for reinstallation reference. (One end of the delay line is soldered to the component side of the Main board and the other end is soldered to the opposite side.

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

9. Unsolder the five crt base pin wires (W9870) from the Main board. The wires are located adjacent to the High Voltage Multiplier (U975) in the Power Supply section.

10. Unsolder the following Line Filter wires from the Main circuit board:

    a. The gray-black-yellow wire from the solder pad labeled W9040.

    b. The gray-brown-white wire from the solder pad labeled W91090.

11. Remove the FOCUS control knob assembly by pulling it straight out from the front panel.

12. Remove the POWER switch extension-shaft assembly as follows:

    a. Press in the POWER button to the ON position.

    b. Insert a scriber (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.

    c. Push the extension shaft forward, then sideways, to clear the switch shaft.

    d. Pull the extension shaft back and out of the instrument.

13. Remove the two screws that secure the power-supply transistor heat sink assembly to the right side of the chassis.

14. Turn the instrument bottom side up. Remove the three screws and hexagonal post spacer that secure the Main circuit board to the bottom attenuator shield.

15. Remove the screw that secures the rear of the Main circuit board to the chassis.

16. Remove the two screws that secure the edge of the Main circuit board to the chassis (located adjacent to the delay line).

17. Lift the front of the Main board slightly and disconnect P2222 and P2223 from their sockets (located at the front of the board).

18. Remove the Main circuit board through the bottom of the instrument chassis.

To reinstall the Main circuit board, perform the reverse of the preceding steps.

OPTIONS

There are currently no options for this instrument 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.

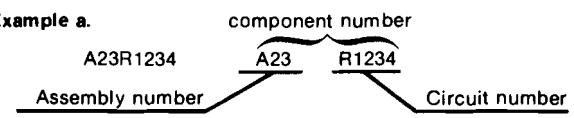
ABBREVIATIONS

Abbreviations conform to American National Standard Y1.1.

COMPONENT NUMBER (column one of the Electrical Parts List)

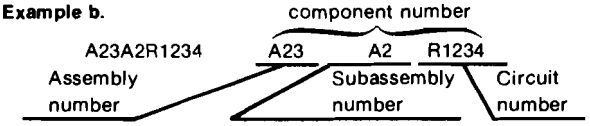
A numbering method has been used to identify assemblies, subassemblies and parts. Examples of this numbering method and typical expansions are illustrated by the following:

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
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
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
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
08806	GENERAL ELECTRIC CO MINIATURE LAMP PRODUCTS DEPT LIGHTING BUSINESS GROUP	NELA PK	CLEVELAND OH 44112
09023	CORNELL-DUBILIER ELECTRONICS DIV FEDERAL PACIFIC ELECTRIC CO	2652 DALRYMPLE ST	SANFORD NC 27330
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
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
14433	ITT SEMICONDUCTORS DIV		WEST PALM BEACH FL
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
15454	KETMA RODAN DIVISION	2900 BLUE STAR STREET	ANAHEIM CA 92806-2591
17735	AT & T TECHNOLOGIES INC SUB OF AMERICAN TELEPHONE AND TELEGRAPH	KANSAS CITY WORK 777 N BLUE PKY	LEES SUMMIT MO 64063-5712
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
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
22229	SOLITRON DEVICES INC SEMICONDUCTOR GROUP SAN DIEGO OPERS	8808 BALBOA AVE	SAN DIEGO CA 92123
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
25403	AMPEREX ELECTRONIC CORP SEMICONDUCTOR SOLID STATE AND ACTIVE DEVICES-ELECTRO OPTICAL DEVICES	GEORGE WASHINGTON HWY	SMITHFIELD RI 02917
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507-2114
34899	FAIR-RITE PRODUCTS CORP	1 COMMERCIAL ROW	WALLKILL NY 12589
50139	ALLEN-BRADLEY CO ELECTRONIC COMPONENTS	1414 ALLEN BRADLEY DR	EL PASO TX 79936
51406	MURATA ERIE NORTH AMERICA INC HEADQUARTERS AND GEORGIA OPERATIONS	2200 LAKE PARK DR	SMYRNA GA 30080
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
54937	DEYOUNG MANUFACTURING INC	12920 NE 125TH WAY	KIRKLAND WA 98034-7716

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
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
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK NE 68701-2242
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
58361	QUALITY TECHNOLOGIES CORP	3400 HILLVIEW AVE	PALO ALTO CA 94304-1319
59821	MEPCO/CENTRALAB A NORTH AMERICAN PHILIPS CO	7158 MERCHANT AVE	EL PASO TX 79915-1207
64053	COILTRON INC	6755 SW SANDBURG ST	TIGARD OR 97223-8008
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
71744	CHICAGO MINIATURE LAMP INC	CHEVY CHASE BUSINESS PARK 1080 JOHNSON DRIVE	BUFFALO GROVE IL 60089
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
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
82104	STANDARD GRIBSBY INC	920 RATHBONE AVE	AURORA IL 60507
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
TK0510	PANASONIC COMPANY DIV OF MATSUSHITA ELECTRIC CORP	ONE PANASONIC WAY	SECAUCUS NJ 07094
TK0900	UNITED CHEMI-CON INC	9801 W HIGGINS SUITE 430	ROSEMONT IL 60018-4704
TK1326	NORTHWEST FOURSLIDE INC	18224 SW 100TH CT	TUALATIN OR 97062
TK1339	PREM MAGNETICS INC	3521 N CHAPEL HILL RD	MCHENRY IL 60050
TK1395	ROEDERSTEIN ELECTRONICS INC	2100 W FRONT ST	STATESVILLE NC 28677-3651
TK1450	TOKYO COSMOS ELECTRIC CO LTD	2-268 SOBUDAI ZAWA	KANAGAWA 228 JAPAN
TK1544	COMPUTER CONNECTIONS	30608 SAN ANTONIO ST	HAYWARD CA 94544
TK1913	WIMA THE INTER-TECHNICAL GROUP IND	ONE BRIOGE ST PO BOX 23	IRVINGTON NY 10533
TK2048	UNION CARBIDE INC KEMET DIV	401 PARK PL SUITE 219	KIRKLAND WA 98033
TK2058	TDK CORPORATION OF AMERICA	2254 N FIRST ST	SAN JOSE CA 95131
U4144	MURATA ELECTRONICS UK LTD	SOUTHWOOD FARNBOROUGH	HANTS ENGLAND

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	671-1418-00			CIRCUIT BD ASSY:MAIN	80009	671-1418-00
A2	671-1423-00			CIRCUIT BD ASSY:ATTEN	80009	671-1423-00
A3	671-1415-00			CIRCUIT BD ASSY:FRONT PANEL	80009	671-1415-00
A4	671-1420-00			CIRCUIT BD ASSY:TIMING	80009	671-1420-00
A5	671-1422-00			CIRCUIT BD ASSY:ALT SWEEP	80009	671-1422-00
A6	670-7615-01			CIRCUIT BD ASSY:EMI FILTER	80009	670-7615-01
A7	671-1463-00			CIRCUIT BD ASSY:SCALE ILLUM	80009	671-1463-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1	671-1418-00			CIRCUIT BD ASSY:MAIN	80009	671-1418-00
A1C100	283-0853-00			CAP,FXD,CER DI:2.2PF,200V	TK2048	C322C22902G5CA
A1C114	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C115	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C116	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C120	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C125	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	SA101C472KAA
A1C126	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C127	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C130	283-0159-00			CAP,FXD,CER DI:18PF,5%,50V	04222	SR155A180JAA
A1C133	281-0785-00			CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
A1C150	283-0853-00			CAP,FXD,CER DI:2.2PF,200V	TK2048	C322C22902G5CA
A1C164	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C165	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C175	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	SA101C472KAA
A1C176	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C177	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C180	281-0327-00			CAP,VAR,CER DI:4.5-30PF,250VDC	52769	GKU30046
A1C198	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C199	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
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
A1C204	281-0811-00			CAP,FXD,CER DI:10PF,10%,100V	04222	MA101A100KAA
A1C210	281-0797-00	B010100	B010245	CAP,FXD,CER DI:15PF,10%,100V	04222	SA106A150KAA
A1C210	281-0756-00	B010246		CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
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	SA101C472KAA
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	283-0665-00			CAP,FXD,MICA DI:190PF,1%,100V	00853	D155F191F0
A1C229	283-0665-00			CAP,FXD,MICA DI:190PF,1%,100V	00853	D155F191F0
A1C237	281-0327-00			CAP,VAR,CER DI:4.5-30PF,250VDC	52769	GKU30046
A1C239	281-0776-00			CAP,FXD,CER DI:120PF,5%,100V	20932	401E0100AD121J
A1C240	283-0643-00			CAP,FXD,MICA DI:22PF,0.5%,500V	00853	D105E220D0
A1C241	281-0777-00			CAP,FXD,CER DI:51PF,5%,100V	04222	MA101A510JAA
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
A1C281	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C282	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
A1C292	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C312	281-0893-00			CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
A1C337	281-0893-00			CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
A1C350	281-0756-00	B010100	B010245	CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A1C350	281-0811-00	B010246		CAP,FXD,CER DI:10PF,10%,100V	04222	MA101A100KAA
A1C363	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C381	283-0637-00			CAP,FXD,MICA DI:20PF,2.5%,500V	00853	D155E200D0
A1C381	283-0637-01			CAP,FXD,MICA DI:20PF,2.5%,500V	09023	CDA15ED200D03
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
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
A1C402	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C406	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C409	283-0167-00			CAP,FXD,CER DI:0.1UF,10%,100V	80009	283-0167-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1C410	283-0051-00			CAP,FXD,CER DI:0.0033UF,5%,100V	04222	SR301A332JAA
A1C414	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
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	281-0851-00			CAP,FXD,CER DI:180PF,5%,100VDC	04222	MA101A181JAA
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	SA101C472KAA
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
A1C460	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C467	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C469	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
A1C487	281-0785-00			CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
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	281-0903-00			CAP,FXD,CER DI:3.9PF,100V	04222	MA101A3R9DAA
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	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
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	SA101C472KAA
A1C507	290-0776-04			CAP,FXD,ELCTLT:22UF,20%,10V,MI	80009	290-0776-04
A1C517	281-0772-00			CAP,FXD,CER DI:4700PF,10%,100V	04222	SA101C472KAA
A1C518	281-0852-00			CAP,FXD,CER DI:1800PF,10%,100VDC	04222	MA101C182KAA
A1C519	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
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	281-0785-00			CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
A1C531	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C537	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
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	290-0776-04			CAP,FXD,ELCTLT:22UF,20%,10V,MI	80009	290-0776-04
A1C545	285-1345-00			CAP,FXD,PLASTIC:2200PF,100V,5%	55112	185(2200PF)
A1C547	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A1C565	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A1C590	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
A1C603	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C635	281-0826-00			CAP,FXD,CER DI:2200PF,10%,100V	20932	401EM100AD222K
A1C646	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A1C647	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C648	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C649	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A1C673	281-0797-00			CAP,FXD,CER DI:15PF,10%,100V	04222	SA106A150KAA
A1C764	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A1C771	281-0777-00			CAP,FXD,CER DI:51PF,5%,100V	04222	MA101A510JAA
A1C774	281-0327-00			CAP,VAR,CER DI:4.5-30PF,250VDC	52769	GKU30046
A1C775	281-0940-00			CAP,FXD,CER DI:1.5PF,+/-0.25PF,100V	04222	MA101A1R5CAA
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
A1C781	281-0777-00			CAP,FXD,CER DI:51PF,5%,100V	04222	MA101A510JAA
A1C782	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C784	281-0811-00			CAP,FXD,CER DI:10PF,10%,100V	04222	MA101A100KAA
A1C785	281-0940-00			CAP,FXD,CER DI:1.5PF,+/-0.25PF,100V	04222	MA101A1R5CAA

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
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	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C797	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C799	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
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	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C832	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C835	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C845	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA106E222MAA
A1C846	281-0756-00			CAP,FXD,CER DI:2.2PF,+/-0.5PF,200V	04222	SA102A2R2DAA
A1C847	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C849	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C851	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C853	281-0767-00			CAP,FXD,CER DI:330PF,20%,100V	04222	MA106C331MAA
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	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C873	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C875	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C877	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
A1C881	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	00853	301EN271W040B2
A1C882	285-1100-00			CAP,FXD,PLASTIC:0.022UF,5%,200V	19396	223J02PT485
A1C893	283-0279-00			CAP,FXD,CER DI:0.001UF,20%,3000V	51406	DHR12Y5S102M3KV
A1C904	285-1222-00			CAP,FXD,PLASTIC:0.068UF,20%,250V	55112	158/.068/M/250/H
A1C906	290-1206-00			CAP,FXD,ELCTLT:270UF,20%,450V	TK0900	
A1C907	285-1177-01			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	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C925	290-0973-00			CAP,FXD,ELCTLT:100UF,20%,25VDC	55680	ULB1E101MPA
A1C940	290-0922-00			CAP,FXD,ELCTLT:1000UF,20%,50V	55680	ULB1E102TFAANA
A1C941	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPACING	TK1913	MKS 2 0.1/250/20
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	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A1C954	290-0947-00			CAP,FXD,ELCTLT:33UF,+50-10%,160V W/SLEEVE	55680	UHC2C330TFA
A1C956	290-0768-00			CAP,FXD,ELCTLT:10UF,+50-20%,100WVDC	54473	ECE-A100V10L
A1C957	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	00853	301EN271W040B2
A1C960	290-1129-00			CAP,FXD,ELCTLT:1000UF,+100%-10%,12V	56289	ORDER BY DESCR
A1C961	290-1129-00			CAP,FXD,ELCTLT:1000UF,+100%-10%,12V	56289	ORDER BY DESCR
A1C962	290-1129-00			CAP,FXD,ELCTLT:1000UF,+100%-10%,12V	56289	ORDER BY DESCR
A1C963	290-1129-00			CAP,FXD,ELCTLT:1000UF,+100%-10%,12V	56289	ORDER BY DESCR
A1C968	290-1129-00			CAP,FXD,ELCTLT:1000UF,+100%-10%,12V	56289	ORDER BY DESCR
A1C970	290-0989-00			CAP,FXD,ELCTLT:4700UF,20%,10V	TK0510	ECEA1AS472
A1C975	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	56289	430P582

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
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
A1C987	285-1100-00			CAP,FXD,PLASTIC:0.022UF,5%,200V	19396	223J02PT485
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)
A1CR200	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR201	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR202	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR203	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
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)
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)
A1CR405	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR406	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR409	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)
A1CR419	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR467	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR476	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR477	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR501	152-0075-00			SEMICOND DVC,DI:SW,GE,22V,80MW,DO-7	80009	152-0075-00
A1CR502	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR503	152-0951-00			DIODE,SIG:SCHTKY,;60V,2.25PF;1N6263(HSCH1001),DO-35,TR	80009	152-0951-00
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)
A1CR564	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR641	152-0951-00			DIODE,SIG:SCHTKY,;60V,2.25PF;1N6263(HSCH1001),DO-35,TR	80009	152-0951-00
A1CR647	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR648	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR649	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR712	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR731	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)
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)
A1CR805	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)
A1CR823	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR824	152-0951-00			DIODE,SIG:SCHTKY,;60V,2.25PF;1N6263(HSCH1001),DO-35,TR	80009	152-0951-00
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	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR853	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1CR854	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR855	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR882	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
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	152-0661-01			SEMICOND DVC,DI:RECT,SI,600V,3A	80009	152-0661-01
A1CR908	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR920	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR946	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR947	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR948	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A1CR954	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR955	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR956	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR957	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR960	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR961	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR962	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR963	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR965	152-0400-00			SEMICOND DVC,DI:RECT,SI,400V,1A	14552	MB2501
A1CR967	152-0581-00			SEMICOND DVC,DI:RECT,SI,20V,1A,A59	80009	152-0581-00
A1CR970	152-0581-04			SEMICOND DVC,DI:RECT,SI,20V,1A,A59	04713	1N5817RL
A1DS856	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	71744	A1B-120
A1DS858	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	71744	A1B-120
A1DS870	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	71744	A1B-120
A1E200	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E201	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E272	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E590	276-0752-00			CORE,EM:FERRITE	34899	2743001111
A1E970	276-0635-00			CORE,EM:TOROID,FERRITE	02114	768 T188/3E2A
A1J2222	136-0949-00			SKT,PL-IN ELEK:18 POS,SIP,LOW PROFILE	80009	136-0949-00
A1J2223	136-0949-00			SKT,PL-IN ELEK:18 POS,SIP,LOW PROFILE	80009	136-0949-00
A1J2300	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J2400	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J2500	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J2600	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J2700	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J2850	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9103	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9108	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9400	131-4888-00			CONN,RCPT,ELEC:HEADER,1 X 15	80009	131-4888-00
A1J9644	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9870	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9882	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1J9884	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1L266	108-1488-00			COIL,RF:FXD,1UH,10%	80009	108-1488-00
A1L267	108-1488-00			COIL,RF:FXD,1UH,10%	80009	108-1488-00
A1L451	108-1488-00			COIL,RF:FXD,1UH,10%	80009	108-1488-00
A1L499	108-1488-00			COIL,RF:FXD,1UH,10%	80009	108-1488-00
A1L956	108-1319-00			INDUCTOR,FIXED:33UH,10%,1.8A	80009	108-1319-00
A1L960	108-1319-00			INDUCTOR,FIXED:33UH,10%,1.8A	80009	108-1319-00
A1L961	108-1319-00			INDUCTOR,FIXED:33UH,10%,1.8A	80009	108-1319-00
A1L968	108-1319-00			INDUCTOR,FIXED:33UH,10%,1.8A	80009	108-1319-00
A1Q102	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q103	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q114	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1Q115	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q152	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q153	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
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	151-0944-00			TRANSISTOR,SIG:BIPLOAR,NPN;15V,30A,4.5GHZ;MPS901,TO-92,(BEC PINOUT)TAPE & AMMO PACK	80009	151-0944-00
A1Q203	151-0944-00			TRANSISTOR,SIG:BIPLOAR,NPN;15V,30A,4.5GHZ;MPS901,TO-92,(BEC PINOUT)TAPE & AMMO PACK	80009	151-0944-00
A1Q206	151-0369-00			TRANSISTOR:PNP,SI,X-55	80009	151-0369-00
A1Q207	151-0369-00			TRANSISTOR:PNP,SI,X-55	80009	151-0369-00
A1Q230	151-0271-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0271-00
A1Q231	151-0271-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0271-00
A1Q254	151-0752-01			TRANSISTOR:NPN,SI,MARCO T	04713	SRF3188
A1Q255	151-0752-01			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
A1Q283	151-0736-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0736-00
A1Q284	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q285	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q302				Q302 & Q303 MATCHED		
A1Q302	151-0711-01			TRANSISTOR:NPN,SI,TO-92	04713	SPS8608M
A1Q327				Q327 & Q328 MATCHED		
A1Q327	151-0711-01			TRANSISTOR:NPN,SI,TO-92	04713	SPS8608M
A1Q328	151-0711-01			TRANSISTOR:NPN,SI,TO-92	04713	SPS8608M
A1Q369	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q381	151-1042-01			SEMICOND DVC SE:FET,SI,TO-92	22229	
A1Q382	151-1042-00			SEMICOND DVC SE:FET,SI,TO-92 (LOCATIONS A & B)	80009	151-1042-00
A1Q384	151-0711-02			TRANSISTOR:NPN,SI,TO-92	80009	151-0711-02
A1Q392	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q397	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q399	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q400	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q402	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q406	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q409	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q409	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
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	151-0711-02			TRANSISTOR:NPN,SI,TO-92	80009	151-0711-02
A1Q421	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q422	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A1Q423	151-0424-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0424-00
A1Q428	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q429	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A1Q440	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q441	151-0711-00			TRANSISTOR:NPN,SI,TO-92B	80009	151-0711-00
A1Q446	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q450	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q473	151-0276-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0276-00
A1Q474	151-0276-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0276-00
A1Q476	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q477	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q487	151-0424-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0424-00
A1Q501	151-0216-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0216-00
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

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1Q525	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q555	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
A1Q583	151-0198-00			TRANSISTOR:SELECTED	80009	151-0198-00
A1Q586	151-0198-00			TRANSISTOR:SELECTED	80009	151-0198-00
A1Q641	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q768	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A1Q770	151-0221-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0221-00
A1Q775	151-0347-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0347-00
A1Q778	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q779	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	2N5401
A1Q780	151-0424-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0424-00
A1Q785	151-0347-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0347-00
A1Q789	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	2N5401
A1Q804	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q814	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A1Q825	151-0424-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0424-00
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	80009	151-0347-00
A1Q845	151-0350-00			TRANSISTOR:PNP,SI,TO-92	04713	2N5401
A1Q882	151-0736-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0736-00
A1Q885	151-0443-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0443-00
A1Q908	151-0164-00			TRANSISTOR:PNP,SI,TO-92	04713	MPS2907A
A1Q928	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	27014	TO7391E2
A1Q930	151-0164-00			TRANSISTOR:PNP,SI,TO-92	04713	MPS2907A
A1Q935	151-0565-00			THYRISTOR,SCR:8A,200V,SENS GATE,TO-220 W/LEADFORM	80009	151-0565-00
A1Q938	151-0276-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0276-00
A1Q939	151-0276-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0276-00
A1Q944	151-0432-00			TRANSISTOR:NPN,SI,625MW,TO-92	27014	TO7391E2
A1Q946	151-0852-00			TRANSISTOR:	80009	151-0852-00
A1Q947	151-0852-00			TRANSISTOR:	80009	151-0852-00
A1Q9070	151-1245-00			TRANSISTOR:MOSFET,N-CHAN,TO-220	80009	151-1245-00
A1R100	313-1430-00			RES,FXD,FILM:43 OHM,5%,0.2W	57668	TR20JT68 43E
A1R101	313-1430-00			RES,FXD,FILM:43 OHM,5%,0.2W	57668	TR20JT68 43E
A1R102	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 402E
A1R103	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 402E
A1R104	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A1R105	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=TO	91637	CCF50-2G110R0F
A1R106	322-3161-00			RES,FXD,FILM:464 OHM,1%,0.2W,TC=TO	91637	CCF50-2G464R0F
A1R108	322-3223-00			RES,FXD,FILM:2.05K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 2K05
A1R109	322-3221-00			RES,FXD,FILM:1.96K OHM,1%,0.2W,TC=TO	80009	322-3221-00
A1R113	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 1K00
A1R114	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 1K50
A1R115	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 1K50
A1R116	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R117	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 1K00
A1R118	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 1K00
A1R119	322-3293-00			RES,FXD,FILM:11K OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 11K0
A1R120	322-3123-00			RES,FXD,FILM:187 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 187E
A1R121	322-3123-00			RES,FXD,FILM:187 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 187E
A1R122	313-1820-00			RES,FXD,FILM:82 OHM,5%,0.2W	57668	TR20JE 82E
A1R123	313-1622-00			RES,FXD,FILM:6.2K OHM,5%,0.2W	57668	TR20JE 06K2
A1R124	313-1622-00			RES,FXD,FILM:6.2K OHM,5%,0.2W	57668	TR20JE 06K2
A1R125	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 604E
A1R126	322-3160-00			RES,FXD,FILM:453 OHM,1%,0.2W,TC=TO	57668	CRB20 FXE 453E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R127	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R130	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R131	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R132	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R133	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=T0	91637	CCF50-2G110R0F
A1R135	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R136	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R138	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A1R139	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R142	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R143	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R144	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R145	311-2271-00			RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W	80009	311-2271-00
A1R150	313-1430-00			RES,FXD,FILM:43 OHM,5%,0.2W	57668	TR20JT68 43E
A1R151	313-1430-00			RES,FXD,FILM:43 OHM,5%,0.2W	57668	TR20JT68 43E
A1R152	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 402E
A1R153	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 402E
A1R154	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=T0	91637	CCF50-2G110R0F
A1R155	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=T0	91637	CCF50-2G110R0F
A1R156	322-3161-00			RES,FXD,FILM:464 OHM,1%,0.2W,TC=T0	91637	CCF50-2G464R0F
A1R158	322-3223-00			RES,FXD,FILM:2.05K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K05
A1R159	322-3221-00			RES,FXD,FILM:1.96K OHM,1%,0.2W,TC=T0	80009	322-3221-00
A1R163	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R164	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R165	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R166	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R167	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R168	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R169	322-3293-00			RES,FXD,FILM:11K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 11K0
A1R170	322-3123-00			RES,FXD,FILM:187 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 187E
A1R171	322-3123-00			RES,FXD,FILM:187 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 187E
A1R172	313-1820-00			RES,FXD,FILM:82 OHM,5%,0.2W	57668	TR20JE 82E
A1R173	313-1622-00			RES,FXD,FILM:6.2K OHM,5%,0.2W	57668	TR20JE 06K2
A1R174	313-1622-00			RES,FXD,FILM:6.2K OHM,5%,0.2W	57668	TR20JE 06K2
A1R175	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A1R176	322-3160-00			RES,FXD,FILM:453 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 453E
A1R177	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R180	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R181	313-1510-00			RES,FXD,FILM:51 OHM,5%,0.2W	80009	313-1510-00
A1R182	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R183	322-3101-00			RES,FXD,FILM:110 OHM,1%,0.2W,TC=T0	91637	CCF50-2G110R0F
A1R185	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R186	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R188	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A1R189	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R192	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R193	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R194	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R195	311-2271-00			RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W	80009	311-2271-00
A1R200	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A1R202	322-3178-00			RES,FXD,FILM:698 OHM,1%,0.2W,TC=T0	91637	CCF50-2G698R0F
A1R203	322-3178-00			RES,FXD,FILM:698 OHM,1%,0.2W,TC=T0	91637	CCF50-2G698R0F
A1R204	322-3089-00			RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	57668	CRB20 FXE 82E5
A1R206	322-3139-00			RES,FXD,FILM:274 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 274E
A1R207	322-3139-00			RES,FXD,FILM:274 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 274E
A1R210	313-1121-00	B010100	B010245	RES,FXD,FILM:120 OHM,5%,0.2W	80009	313-1121-00
A1R210	313-1271-00	B010246		RES,FXD,FILM:270 OHM,5%,0.2W	57668	TR20JE 270E
A1R212	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R213	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R215	322-3135-00			RES,FXD,FILM:249 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 249E
A1R216	322-3163-00			RES,FXD,FILM:487 OHM,1%,0.2W,TC=T0	91637	CCF50-2G487R0F
A1R217	322-3163-00			RES,FXD,FILM:487 OHM,1%,0.2W,TC=T0	91637	CCF50-2G487R0F
A1R218	322-3102-00			RES,FXD,FILM:113 OHM,1%,0.2W,TC=T0	91637	CCF50-2F113R0F
A1R219	322-3102-00			RES,FXD,FILM:113 OHM,1%,0.2W,TC=T0	91637	CCF50-2F113R0F
A1R220	307-0104-00			RES,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5
A1R222	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R223	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R225	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R226	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R227	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R230	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R231	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R233	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R234	313-1360-00			RES,FXD,FILM:36 OHM,5%,0.2W	57668	TR20JE 36E
A1R235	313-1360-00			RES,FXD,FILM:36 OHM,5%,0.2W	57668	TR20JE 36E
A1R236	313-1821-00			RES,FXD,FILM:820 OHM,5%,0.2W	57668	TR20JE 820E
A1R239	313-1242-00			RES,FXD,FILM:2.4K OHM,5%,0.2W	57668	TR20JE 02K4
A1R240	311-2257-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.5W	80009	311-2257-00
A1R241	311-2273-00			RES,VAR,NONWW:TRMR,2K OHM,20%,0.5W	80009	311-2273-00
A1R242	313-1273-00			RES,FXD,FILM:27K OHM,5%,0.2W	57668	TR20JE 27K
A1R244	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A1R245	322-3172-00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 604E
A1R250	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R251	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R254	322-3110-00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50-2G137R0F
A1R255	322-3110-00			RES,FXD,FILM:137 OHM,1%,0.2W,TC=T0	91637	CCF50-2G137R0F
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	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A1R266	307-1502-02			NTWK,HYBRID CKT:VERTICAL OUTPUT SUBSTRATE	17735	1669A
A1R279	313-1223-00			RES,FXD,FILM:22K,OHM,5%,0.2W	57668	TR20JE 22K
A1R281	313-1821-00			RES,FXD,FILM:820 OHM,5%,0.2W	57668	TR20JE 820E
A1R282	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A1R283	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R284	313-1621-00			RES,FXD,FILM:620 OHM,5%,0.2W	57668	TR20JE 620E
A1R285	313-1561-00			RES,FXD,FILM:560 OHM,5%,0.2W	57668	TR20JE 560E
A1R286	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A1R287	322-3068-00			RES,FXD,FILM:49.9 OHM,1%,0.2W,TC=T0	80009	322-3068-00
A1R288	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R289	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R292	322-3178-00			RES,FXD,FILM:698 OHM,1%,0.2W,TC=T0	91637	CCF50-2G698R0F
A1R293	322-3085-00			RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A1R301	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R302	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R303	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R304	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R305	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R306	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R307	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R309	311-2230-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A1R310	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R311	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R312	322-3098-00			RES,FXD,FILM:102 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 102E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R314	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 576E
A1R315	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 576E
A1R317	322-3243-00			RES,FXD,FILM:3.32K OHM,1%,0.2W,TC=T0	80009	322-3243-00
A1R318	322-3243-00			RES,FXD,FILM:3.32K OHM,1%,0.2W,TC=T0	80009	322-3243-00
A1R319	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R320	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R321	322-3208-00			RES,FXD,FILM:1.43K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K43
A1R322	322-3238-00			RES,FXD,FILM:2.94K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K94
A1R324	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R326	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R327	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R328	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R329	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R330	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R331	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R332	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R335	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K27
A1R336	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K27
A1R337	322-3098-00			RES,FXD,FILM:102 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 102E
A1R339	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 576E
A1R340	322-3170-00			RES,FXD,FILM:576 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 576E
A1R342	322-3243-00			RES,FXD,FILM:3.32K OHM,1%,0.2W,TC=T0	80009	322-3243-00
A1R343	322-3243-00			RES,FXD,FILM:3.32K OHM,1%,0.2W,TC=T0	80009	322-3243-00
A1R344	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R345	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R346	322-3208-00			RES,FXD,FILM:1.43K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K43
A1R347	322-3238-00			RES,FXD,FILM:2.94K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K94
A1R349	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R350	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R351	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R352	322-3274-00			RES,FXD,FILM:6.98K OHM,1%,0.2W,TC=T0	91637	CCF502G69800FT
A1R353	322-3274-00			RES,FXD,FILM:6.98K OHM,1%,0.2W,TC=T0	91637	CCF502G69800FT
A1R354	313-1272-00			RES,FXD,FILM:2.7K OHM,5%,0.2W	57668	TR20JE 02K7
A1R356	313-1622-00			RES,FXD,FILM:6.2K OHM,5%,0.2W	57668	TR20JE 06K2
A1R357	322-3149-00			RES,FXD,FILM:348 OHM,1%,0.2W,TC=T0	80009	322-3149-00
A1R358	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R359	322-3148-00			RES,FXD,FILM:340 OHM,1%,0.2W,TC=T0	80009	322-3148-00
A1R360	322-3156-00			RES,FXD,FILM:412 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 412E
A1R361	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R363	313-1331-00			RES,FXD,FILM:330 OHM,5%,0.2W	57668	TR20JE 330E
A1R364	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R365	313-1620-00			RES,FXD,FILM:62 OHM,5%,0.2W	57668	TR20JT6862E0
A1R366	322-3222-00			RES,FXD,FILM:2K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K00
A1R367	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A1R368	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R369	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R372	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A1R373	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K27
A1R374	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R375	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R381	322-3444-00			RES,FXD,FILM:412K OHM,1%,0.2W,TC=T0	91637	CCF50-2F41202F
A1R382	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R383	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R384	313-1121-00			RES,FXD,FILM:120 OHM,5%,0.2W	80009	313-1121-00
A1R385	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
A1R386	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A1R387	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5W	80009	311-2269-00
A1R388	313-1822-00			RES,FXD,FILM:8.2K,OHM,5%,0.2W	57668	TR20JE 08K2

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A1R389	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R390	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R391	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R392	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R393	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A1R394	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R395	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A1R396	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R397	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A1R398	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R399	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R400	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R402	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
A1R403	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A1R404	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R405	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R406	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R407	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A1R408	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R409	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A1R410	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K30
A1R411	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R412	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R413	322-3293-00			RES,FXD,FILM:11K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 11K0
A1R414	313-1244-00			RES,FXD,FILM:240K OHM,5%,0.2W	57668	TR20JE 240K
A1R415	313-1244-00			RES,FXD,FILM:240K OHM,5%,0.2W	57668	TR20JE 240K
A1R416	313-1473-00			RES,FXD,FILM:47K OHM,5%,0.2W	57668	TR20JE 47K
A1R417	313-1473-00			RES,FXD,FILM:47K OHM,5%,0.2W	57668	TR20JE 47K
A1R419	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A1R420	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R421	322-3306-00			RES,FXD,FILM:15K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K0
A1R422	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R423	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R424	322-3306-00			RES,FXD,FILM:15K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K0
A1R426	313-1434-00			RES,FXD,FILM:430K OHM,5%,0.2W	91637	CCF50-2-64303JT
A1R427	313-1434-00			RES,FXD,FILM:430K OHM,5%,0.2W	91637	CCF50-2-64303JT
A1R428	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R429	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R431	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R432	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R433	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R434	311-2262-00			RES,VAR,NONWW:TRMR,1M OHM,20%,0.5W	80009	311-2262-00
A1R435	311-2262-00			RES,VAR,NONWW:TRMR,1M OHM,20%,0.5W	80009	311-2262-00
A1R436	313-1242-00			RES,FXD,FILM:2.4K OHM,5%,0.2W	57668	TR20JE 02K4
A1R437	313-1242-00			RES,FXD,FILM:2.4K OHM,5%,0.2W	57668	TR20JE 02K4
A1R439	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R440	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R441	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R442	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R443	322-3086-00			RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A1R444	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R445	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R446	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R447	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R448	313-1270-00			RES,FXD,FILM:27 OHM 5%,0.2W	57668	TR20JT68 27E
A1R449	313-1270-00			RES,FXD,FILM:27 OHM 5%,0.2W	57668	TR20JT68 27E
A1R450	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R452	322-3130-00			RES,FXD,FILM:221 OHM,1%,0.2W,TC=T0	80009	322-3130-00

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A1R453	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R455	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R457	322-3145-00			RES,FXD,FILM:316 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 316E
A1R458	322-3182-00			RES,FXD,FILM:768 OHM,1%,0.2W,TC=T0	80009	322-3182-00
A1R459	322-3180-00			RES,FXD,FILM:732 OHM,1%,0.2W,TC=T0	80009	322-3180-00
A1R460	322-3141-00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 287E
A1R461	322-3141-00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 287E
A1R462	322-3196-00			RES,FXD,FILM:1.07K OHM,1%,0.2W,TC=T0	80009	322-3196-00
A1R463	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	80009	322-3215-00
A1R464	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R465	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R467	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A1R468	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A1R469	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A1R470	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A1R473	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A1R474	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R476	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R477	322-3205-00			RES,FXD,FILM:1.33K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K33
A1R478	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	80009	322-3215-00
A1R479	311-2273-00			RES,VAR,NONWW:TRMR,2K OHM,20%,0.5W	80009	311-2273-00
A1R480	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R481	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R482	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R486	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R487	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R488	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R492	313-1270-00			RES,FXD,FILM:27 OHM 5%,0.2W	57668	TR20JT68 27E
A1R494	307-0104-00			RES,FXD,CMPSN:3.3 OHM,5%,0.25W	01121	CB33G5
A1R500	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R501	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A1R502	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A1R503	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A1R504	313-1124-00			RES,FXD,FILM:120K OHM,5%,0.2W	57668	TR20JE120K
A1R505	313-1473-00			RES,FXD,FILM:47K OHM,5%,0.2W	57668	TR20JE 47K
A1R506	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R507	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R508	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R509	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A1R510	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R511	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
A1R512	313-1432-00			RES,FXD,FILM:4.3K OHM,5%,0.2W	57668	TR20JE 04K3
A1R513	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R514	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R516	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A1R517	313-1432-00			RES,FXD,FILM:4.3K OHM,5%,0.2W	57668	TR20JE 04K3
A1R518	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R523	322-3306-00			RES,FXD,FILM:15K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K0
A1R524	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R525	322-3322-00			RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A1R526	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A1R527	313-1472-00			RES,FXD,FILM:4.7K OHM,5%,0.2W	57668	TR20JE 04K7
A1R528	322-3197-00			RES,FXD,FILM:1.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K10
A1R529	313-1822-00			RES,FXD,FILM:8.2K,OHM,5%,0.2W	57668	TR20JE 08K2
A1R540	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R541	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R544	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A1R545	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R547	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R548	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R549	313-1681-00			RES,FXD,FILM:680 OHM,5%,0.2W	57668	TR20JE 680E
A1R550	307-0445-00			RES NTWK,FXD,FI:4.7K OHM,20%,(9)RES	32997	4310R-101-472
A1R554	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R555	313-1821-00			RES,FXD,FILM:820 OHM,5%,0.2W	57668	TR20JE 820E
A1R564	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R565	313-1301-00			RES,FXD,FILM:300 OHM,5%,0.2W,MI	57668	TR20JT68-300E
A1R566	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	57668	TR20JT68 510E
A1R568	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
A1R569	313-1432-00			RES,FXD,FILM:4.3K OHM,5%,0.2W	57668	TR20JE 04K3
A1R571	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A1R572	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R573	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A1R574	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R576	313-1561-00			RES,FXD,FILM:560 OHM,5%,0.2W	57668	TR20JE 560E
A1R577	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A1R578	313-1561-00			RES,FXD,FILM:560 OHM,5%,0.2W	57668	TR20JE 560E
A1R580	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A1R582	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A1R583	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R586	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R591	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R641	313-1472-00			RES,FXD,FILM:4.7K OHM,5%,0.2W	57668	TR20JE 04K7
A1R645	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A1R646	311-2258-00			RES,VAR,NONWW:TRMR,1K OHM,20%,0.5W	TK1450	GF06VT 1 K OHM
A1R647	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R648	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A1R649	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A1R673	313-1472-00			RES,FXD,FILM:4.7K OHM,5%,0.2W	57668	TR20JE 04K7
A1R676	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A1R757	322-3197-00			RES,FXD,FILM:1.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K10
A1R763	322-3130-00			RES,FXD,FILM:221 OHM,1%,0.2W,TC=T0	80009	322-3130-00
A1R764	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A1R766	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A1R768	322-3155-00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 402E
A1R770	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A1R771	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R772	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R773	322-3182-00			RES,FXD,FILM:768 OHM,1%,0.2W,TC=T0	80009	322-3182-00
A1R774	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
A1R775	323-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.5W,TC=T0	75042	CECT0-1652F
A1R776	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K30
A1R777	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R778	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R779	313-1243-00			RES,FXD,FILM:24K OHM,5%,0.2W	80009	313-1243-00
A1R780	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A1R781	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R782	321-0209-00			RES,FXD,FILM:1.47K OHM,1%,0.125W,TC=T0	19701	5033ED1K47F
A1R783	322-3203-00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K27
A1R784	313-1391-00			RES,FXD,FILM:390 OHM,5%,0.2W	57668	TR20JE 390E
A1R785	323-0310-00			RES,FXD,FILM:16.5K OHM,1%,0.5W,TC=T0	75042	CECT0-1652F
A1R786	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K30
A1R787	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A1R788	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R789	313-1243-00			RES,FXD,FILM:24K OHM,5%,0.2W	80009	313-1243-00
A1R792	322-3263-00			RES,FXD,FILM:5.36K OHM,1%,0.2W,TC=T0	56845	ORDER BY DESCR
A1R793	322-3361-00			RES,FXD,FILM:56.2K OHM,1%,0.2W,TC=T0	91637	CCF50-2F56201F

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R796	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R797	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R799	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R804	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R805	313-1562-00			RES,FXD,FILM:5.6K OHM,5%,0.2W	57668	TR20JE 05K6
A1R814	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R818	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R820	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
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	322-3085-00			RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A1R826	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R828	313-1620-00			RES,FXD,FILM:62 OHM,5%,0.2W	57668	TR20JT6862E0
A1R830	322-3212-00			RES,FXD,FILM:1.58K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K58
A1R832	322-3222-00			RES,FXD,FILM:2K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K00
A1R834	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A1R835	322-3228-00			RES,FXD,FILM:2.32K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K32
A1R836	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R840	313-1561-00			RES,FXD,FILM:560 OHM,5%,0.2W	57668	TR20JE 560E
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
A1R843	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R844	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R845	313-1472-00			RES,FXD,FILM:4.7K OHM,5%,0.2W	57668	TR20JE 04K7
A1R846	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A1R849	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R851	311-2236-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5W LINEAR	TK1450	GF06UT 20K
A1R852	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R853	315-0244-00			RES,FXD,FILM:240K OHM,5%,0.25W	19701	5043CX240K0J
A1R854	315-0472-03			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R855	315-0102-00			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	311-2239-00			RES,VAR,NONWW:TRMR,100K OHM,20%,0.5W LINEAR	TK1450	GF06UT 100K
A1R871	315-0102-00			RES,FXD,FILM:1K OHM,5%,0.25W	57668	NTR25JE01K0
A1R872	313-1223-00			RES,FXD,FILM:22K,OHM,5%,0.2W	57668	TR20JE 22K
A1R873	313-1513-00			RES,FXD,CMPSN:51K OHM,5%,0.2W	57668	TR20JE 51K
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
A1R880	322-3314-00			RES,FXD,FILM:18.2K OHM,1%,0.2W,TC=T0	80009	322-3314-00
A1R881	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A1R883	322-3314-00			RES,FXD,FILM:18.2K OHM,1%,0.2W,TC=T0	80009	322-3314-00
A1R884	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K8
A1R885	313-1912-00			RES,FXD,FILM:9.1K OHM,5%,0.2W	57668	TR20 FXE 9.1K
A1R886	315-0184-00			RES,FXD,FILM:180K OHM,5%,0.25W	19701	5043CX180K0J
A1R887	322-3354-00			RES,FXD,FILM:47.5K OHM,1%,0.2W,TC=T0	80009	322-3354-00
A1R888	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R889	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R890	307-2173-00			RES NTWK,FXD,FI:HIGH VOLTAGE,FINISHED	80009	307-2173-00
A1R891	322-3354-00			RES,FXD,FILM:47.5K OHM,1%,0.2W,TC=T0	80009	322-3354-00
A1R893	311-1933-00			RES,VAR,NONWW:PNL,5M OHM,10%,0.5W	01121	23M909
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	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A1R909	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	57668	NTR25J-E39E0
A1R912	322-3162-00			RES,FXD,FILM:475 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 475E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1R913	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R914	322-3378-00			RES,FXD,FILM:84.5K OHM,1%,0.2W,TC=T0	91637	CCF50-2F84501F
A1R915	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R916	313-1514-00			RES,FXD,FILM:510K OHM,5%,0.2W	57668	TR20JE 510K
A1R917	313-1303-00			RES,FXD,FILM:30K OHM,5%,0.2W	57668	TR20JE 30K
A1R919	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A1R921	313-1303-00			RES,FXD,FILM:30K OHM,5%,0.2W	57668	TR20JE 30K
A1R922	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R925	313-1124-00			RES,FXD,FILM:120K OHM,5%,0.2W	57668	TR20JE120K
A1R926	303-0154-00			RES,FXD,CMPSN:150K OHM,5%,1W	24546	FP1 150K OHM 5%
A1R927	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R928	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A1R929	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A1R930	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R935	315-0121-00			RES,FXD,FILM:120 OHM,5%,0.25W	19701	5043CX120R0J
A1R937	322-3234-00			RES,FXD,FILM:2.67K OHM,1%,0.2W,TC=T0	80009	322-3234-00
A1R938	311-1248-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386X-T07-501
A1R939	322-3304-00			RES,FXD,FILM:14.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 14K3
A1R940	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R941	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R942	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A1R943	301-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.5W	19701	5053CX4K700J
A1R944	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
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	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A1R949	308-0755-00			RES,FXD,WW:0.75 OHM,5%,2W	75042	BWH-R7500J
A1R964	307-0106-00			RES,FXD,CMPSN:4.7 OHM,5%,0.25W	01121	CB 47G5
A1R975	315-0470-00			RES,FXD,FILM:47 OHM,5%,0.25W	57668	NTR25J-E47E0
A1R976	315-0472-03			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R978	315-0472-03			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	01121	CB4725
A1R984	311-2257-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.5W	80009	311-2257-00
A1R985	322-3354-00			RES,FXD,FILM:47.5K OHM,1%,0.2W,TC=T0	80009	322-3354-00
A1R986	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R987	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0
A1R988	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A1R989	322-3354-00			RES,FXD,FILM:47.5K OHM,1%,0.2W,TC=T0	80009	322-3354-00
A1R990	311-2269-00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5W	80009	311-2269-00
A1R991	322-3238-00			RES,FXD,FILM:2.94K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K94
A1RT236	307-0125-00			RES,THERMAL:500 OHM,10%,NTC	15454	1DB501K-220-EC
A1S901	260-2443-00			SWITCH,PUSH:POWER,DPST,6A,250VAC	80009	260-2443-00
A1T390	120-1401-00			XFMR,TRIGGER:LINE,1:1 TURNS RATIO	54937	DMI 500-2044
A1T906	120-1439-01			TRANSFORMER,RF:ENERGY STORAGE	TK1339	120-1439-01
A1T944	120-1347-00			TRANSFORMER,RF:DRIVER SATURATING	80009	120-1347-00
A1T948	120-1601-01			XFMR,PWR SDN&UP:HIGH VOLTAGE	80009	120-1601-01
A1TP940	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1TP950	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1U120	156-0495-00			MICROCKT,LINEAR:OPNL AMPL	80009	156-0495-00
A1U130	234-0133-20			INTEGRATED CKT:SH III VERSION OF M-84 VERTICAL AMP	80009	234-0133-20
A1U180	234-0133-20			INTEGRATED CKT:SH III VERSION OF M-84 VERTICAL AMP	80009	234-0133-20
A1U225	156-0067-00			MICROCKT,LINEAR:BIPOLAR,OPNL AMPL	80009	156-0067-00
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 TRANSISTOR ARRAY H FREQ	80009	156-1294-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A1U426	156-0158-00			MICROCKT,LINEAR:BIPOLAR,DUAL OPNL AMPL	80009	156-0158-00
A1U460	234-0107-20			INTEGRATED CKT:SCHMITT TRIGGER	80009	234-0107-20
A1U502	156-1713-00			MICROCKT,DGTL:ECL,RETRIG MONOSTABLE MV	80009	156-1713-00
A1U504	156-1335-00			MICROCKT,DGTL:LSTTL,DUAL RETRIGGERABLE RESETTABLE MONOSTABLE MV,SCRN	80009	156-1335-00
A1U506	156-1639-00			IC,DIGITAL:ECL,FLIP FLOP;DUAL MASTER-SLAVE; 10H131,DIP16.3	80009	156-1639-00
A1U532	156-1641-00			MICROCKT,DGTL:ECL,QUAD 2-INPUT NOR GATE	80009	156-1641-00
A1U537	156-0721-00			IC,DIGITAL:LSTTL,SCHMITT TRIG;QUAD 2-INPUT NAND;74LS132,DIP14.3,TUBE	80009	156-0721-00
A1U540	156-0388-00			IC,DIGITAL:LSTTL,FLIP FLOP;DUAL D-TYPE;74LS 74,DIP14.3,TUBE	80009	156-0388-00
A1U555	160-6757-00			MICROCKT,DGTL:STTL,OCTAL 16-IN A01GAK ARRAY	80009	160-6757-00
A1U565	156-0386-00			IC,DIGITAL:LSTTL,GATES;TRIPLE 3-INPUT NAND; 74LS10,DIP14.3,TUBE	80009	156-0386-00
A1U882	156-0158-00			MICROCKT,LINEAR:BIPOLAR,DUAL OPNL AMPL	80009	156-0158-00
A1U930	156-1627-00			MICROCKT,LINEAR:BIPOLAR,PWM PWR SPLY CONT	12969	UC494ACN
A1U975	152-1046-00			SEMICOND DVC,DI:HV MULTR,4KVAC INPUT,12KVAC	U4144	MSL8524
A1U985	156-0745-00			IC,DIGITAL:CMOS,GATES;HEX INV;4069B,DIP14.3 ,TUBE,CERAMIC	80009	156-0745-00
A1VR200	152-0149-00			SEMICOND DVC,DI:ZEN,SI,10V,5%,0.4W,DO-7	04713	1N961B
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	80009	152-0508-00
A1VR764	152-0702-00			SEMICOND DVC,DI:ZEN,SI,13V,2%,500MW,DO-7	80009	152-0702-00
A1VR782	152-0243-00			SEMICOND DVC,DI:ZEN,SI,15V,5%,0.4W,DO-7	14433	Z5412
A1VR828	152-0514-00			SEMICOND DVC,DI:ZEN,SI,10V,1%,0.4W,DO-7	80009	152-0514-00
A1VR925	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A1VR935	152-0255-00			SEMICOND DVC,DI:ZEN,SI,51V,5%,0.4W,DO-7	80009	152-0255-00
A1VR943	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A1W101	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W102	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W199	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W226	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W262	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W272	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W281	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W282	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W283	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
A1W318	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W343	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
A1W392	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W399	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
A1W494	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W499	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W535	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
A1W551	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W552	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
A1W591	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.
A1W592	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W602	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W603	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W634	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W635	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W636	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W648	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W649	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W732	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A1W881	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
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
A1W957	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
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
A1W966	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
A1W9070	198-4819-01			WIRE SET,ELEC:3 DISCRETE WIRES,22 AWG IN CONN,(9-1)4.25 L,(9-2)4.25 L,(9-3)3.75 L	TK1544	ORDER BY DESCR
A1W9272	196-3257-00			LEAD,ELECTRICAL:22 AWG,3.2 L,9-5	80009	196-3257-00
A1W9273	196-3225-00			LEAD,ELECTRICAL:22 AWG,3.6 L,9-5	80009	196-3225-00
A1W9440	174-1971-00			CA ASSY,SP,ELEC:4,26 AWG,7.0 L,RIBBON	80009	174-1971-00
A1W9700	174-2076-00			CA ASSY,RF:8.26 AWG,COA	TK1544	ORDER BY DESCR
A1W9705	174-1973-00			CA ASSY,SP,ELEC:8,26 AWG,6.0 L,RIBBON	80009	174-1973-00
A1W9778	195-7064-00			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	136-1075-00			SKT,PL-IN ELEK:CRT SOCKET ASSY	TK1544	ORDER BY DESCR
A1W9965	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A1W9991	174-1972-00			CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	174-1972-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2	671-1423-00			CIRCUIT BD ASSY:ATTEN	80009	671-1423-00
A2AT1	307-1014-06			ATTENUATOR,FXD:100X	80009	307-1014-06
A2AT2	307-1013-00			ATTENUATOR,FXD:10X	80009	307-1013-00
A2AT51	307-1014-06			ATTENUATOR,FXD:100X	80009	307-1014-06
A2AT52	307-1013-00			ATTENUATOR,FXD:10X	80009	307-1013-00
A2C2	285-1461-00			CAP,FXD,PLSTC:0.022UF,10%,400V	TK1913	MKP10.02240010
A2C3	281-0294-00			CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C6	285-1462-00			CAP,FXD,PLASTIC:1000PF,20%,400V	TK1913	FKS2100040020
A2C7	281-0305-00			CAP,VAR,CER DI:1.5-4.0PF	52769	GKU 4R000
A2C9	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C10	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C13	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C17	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C19	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C21	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C26	281-0294-00			CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C27	281-0893-00			CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
A2C30	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2C35	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C38	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C52	285-1461-00			CAP,FXD,PLSTC:0.022UF,10%,400V	TK1913	MKP10.02240010
A2C53	281-0294-00			CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C56	285-1462-00			CAP,FXD,PLASTIC:1000PF,20%,400V	TK1913	FKS2100040020
A2C57	281-0305-00			CAP,VAR,CER DI:1.5-4.0PF	52769	GKU 4R000
A2C59	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C60	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C63	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A2C67	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C69	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C71	285-1458-00			CAP,FXD,MTLZD:4700PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0247006310
A2C76	281-0294-00			CAP,VAR,CER DI:6-50PF,250VDC	52769	GKU50000
A2C77	281-0893-00			CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V	04222	MA101A4R7DAA
A2C80	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A2C85	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C88	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C90	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A2C91	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A2C93	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A2C94	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
A2C96	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A2C97	285-1459-00			CAP,FXD,MTLZD:2200PF,10%,63V,2.5MM LEAD SPACING	TK1913	MKS0222006310
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)

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
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)
A2CR85	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2CR88	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A2E90	119-1771-00			FERRITE BEAD AS:276-0532-00 W/22 AWG WIRE	80009	119-1771-00
A2E91	119-1771-00			FERRITE BEAD AS:276-0532-00 W/22 AWG WIRE	80009	119-1771-00
A2J2900	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A2J2950	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A2J9200	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A2J9991	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A2L93	108-1485-00			COIL,RF:FXD,INDUCTOR,220UH,10%,0.41A,BOBBIN CORE,RADIAL LEAD 0.2 IN LEAD SPACING,	TK2058	TSL0707-221KR41
A2L96	108-1485-00			COIL,RF:FXD,INDUCTOR,220UH,10%,0.41A,BOBBIN CORE,RADIAL LEAD 0.2 IN LEAD SPACING,	TK2058	TSL0707-221KR41
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
A2R1	315-0620-02			RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R2	322-3481-00			RES,FXD,FILM:1M OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R3	322-0614-07			RES,FXD,FILM:250K OHM,0.1%,0.25W,TC=T9	19701	5043RE250K0B
A2R4	313-1082-00			RES,FXD,FILM:8.2 OHM,5%,0.2W	80009	313-1082-00
A2R5	321-0469-07			RES,FXD,FILM:750K OHM,0.1%,0.125W,TC=T9	19701	5033RE750K0B
A2R6	315-0105-03			RES,FXD,CMPSN:1M OHM,5%,0.25W	80009	315-0105-03
A2R7	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R8	315-0620-02			RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R9	313-1432-00			RES,FXD,FILM:4.3K OHM,5%,0.2W	57668	TR20JE 04K3
A2R10	311-2238-00			RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R11	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R12	313-1360-00			RES,FXD,FILM:36 OHM,5%,0.2W	57668	TR20JE 36E
A2R13	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R14	313-1161-00			RES,FXD,FILM:160 OHM,5%,0.2W	57668	TR20JE160E
A2R15	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R16	313-1162-00			RES,FXD,FILM:1.6K OHM,5%,0.2W	57668	TR20JT681K6
A2R17	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R18	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A2R19	307-0843-00			RES NTWK,FXD,FI:INPUT ATTENUATOR	80009	307-0843-00
A2R20	313-1332-00			RES,FXD,FILM:3.3K OHM,5%,0.2W	57668	TR20JE 03K3
A2R21	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R22	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R23	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R25	311-2226-00			RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W LINEARTAPE & REEL	TK1450	GF06UT 50 OHM
A2R26	311-0643-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329H-L58-500
A2R27	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R29	322-3089-00	B010100	B011889	RES,FXD,FILM:82.5 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 82E5
A2R29	322-3086-00	B011890		RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A2R30	313-1124-00			RES,FXD,FILM:120K OHM,5%,0.2W	57668	TR20JE120K
A2R31	322-3085-00			RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A2R33	311-2238-00			RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R34	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R35	322-3143-00			RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R37	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R38	322-3143-00			RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R39	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K49
A2R41	322-3318-00			RES,FXD,FILM:20K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 20K0

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2R42	322-3282-00			RES,FXD,FILM:8.45K OHM,1%,0.2W,TC=T0	80009	322-3282-00
A2R43	311-2179-00			RES,VAR,NONWW:PNL,10K OHM,10%,0.5W	32997	91Z1D-Z07-EA0037
A2R46	322-3219-09			RES,FXD,FILM:1.87K OHM,1%,0.2W,TC-T9,SMALL BODY,TAPE & REEL	91637	CCF50-2-C1871FT
A2R47	311-2229-00			RES,VAR,NONWW:TRMR,250 OHM,20%,0.5W LINEAR	TK1450	GF06UT 250
A2R48	322-3276-09			RES,FXD,FILM:7.32K OHM,1%,0.2W,TC=T9,SMALL BODY,TAPE & REEL	91637	CCF50-2-C73200FT
A2R51	315-0620-02			RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R52	322-3481-00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0	57668	CRB20 FXE 1M00
A2R53	322-0614-07			RES,FXD,FILM:250K OHM,0.1%,0.25W,TC=T9	19701	5043RE250K0B
A2R54	313-1082-00			RES,FXD,FILM:8.2 OHM,5%,0.2W	80009	313-1082-00
A2R55	321-0469-07			RES,FXD,FILM:750K OHM,0.1%,0.125W,TC=T9	19701	5033RE750K0B
A2R56	315-0105-03			RES,FXD,CMPSN:1M OHM,5%,0.25W	80009	315-0105-03
A2R57	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R58	315-0620-02			RES,FXD,CMPSN:62 OHM,5%,0.25W	01121	CB6205
A2R59	313-1432-00			RES,FXD,FILM:4.3K OHM,5%,0.2W	57668	TR20JE 04K3
A2R60	311-2238-00			RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R61	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R62	313-1360-00			RES,FXD,FILM:36 OHM,5%,0.2W	57668	TR20JE 36E
A2R63	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R64	313-1161-00			RES,FXD,FILM:160 OHM,5%,0.2W	57668	TR20JE160E
A2R65	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R66	313-1162-00			RES,FXD,FILM:1.6K OHM,5%,0.2W	57668	TR20JT681K6
A2R67	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R68	313-1911-00			RES,FXD,FILM:910 OHM,5%,0.2W	57668	TR20JE910E
A2R69	307-0843-00			RES NTWK,FXD,FI:INPUT ATTENUATOR	80009	307-0843-00
A2R71	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R72	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R73	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A2R75	311-2226-00			RES,VAR,NONWW:TRMR,50 OHM,20%,0.5W LINEARTAPE & REEL	TK1450	GF06UT 50 OHM
A2R76	311-0643-00			RES,VAR,NONWW:TRMR,50 OHM,0.5W	32997	3329H-L58-500
A2R77	313-1160-00			RES,FXD,FILM:16 OHM,0.5%,0.2W	80009	313-1160-00
A2R79	322-3089-00	B010100	B011889	RES,FXD,FILM:82.5 OHM,1%.0.2W,TC=T0	57668	CRB20 FXE 82E5
A2R79	322-3086-00	B011890		RES,FXD,FILM:76.8 OHM,1%,0.2W,TC=T0	91637	CCF50-2G76R80F
A2R80	313-1124-00			RES,FXD,FILM:120K OHM,5%,0.2W	57668	TR20JE120K
A2R81	322-3085-00			RES,FXD,FILM:75 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 75E0
A2R83	311-2238-00			RES,VAR,NONWW:TRMR,50K OHM,20%,0.5W LINEAR	TK1450	GF06UT 50 K
A2R84	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A2R85	322-3143-00			RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R87	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A2R88	322-3143-00			RES,FXD,FILM:301 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 301E
A2R91	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K8
A2R92	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A2R93	311-2179-00			RES,VAR,NONWW:PNL,10K OHM,10%,0.5W	32997	91Z1D-Z07-EA0037
A2R96	313-1182-00			RES,FXD,FILM:1.8K OHM 5%,0.2W	57668	TR20JT681K8
A2R97	311-2230-00			RES,VAR,NONWW:TRMR,500 OHM,20%,0.50 LINEAR	TK1450	GF06UT 500
A2R98	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A2S1	263-1040-03			SWITCH ASSEMBLY:ACTUATOR,COUPLING	80009	263-1040-03
A2S10	263-1041-02			SWITCH ASSEMBLY:ACTUATOR,VOLTS/DIV	80009	263-1041-02
A2S51	263-1040-03			SWITCH ASSEMBLY:ACTUATOR,COUPLING	80009	263-1040-03
A2S60	263-1041-02			SWITCH ASSEMBLY:ACTUATOR,VOLTS/DIV	80009	263-1041-02
A2U10	156-2469-00			MICROCKT,DGTL:OP AMP	80009	156-2469-00
A2U30	234-0134-20			QUICK CHIP:VERTICAL AMPLIFIER,IC	80009	234-0134-20
A2U60	156-2469-00			MICROCKT,DGTL:OP AMP	80009	156-2469-00
A2U80	234-0134-20			QUICK CHIP:VERTICAL AMPLIFIER,IC	80009	234-0134-20
A2U90	156-0991-00			MICROCKT,LINEAR:VOLTAGE REGULATOR	80009	156-0991-00
A2U91	156-0991-00			MICROCKT,LINEAR:VOLTAGE REGULATOR	80009	156-0991-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A2W9103	174-1972-00			CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	174-1972-00
A2W9108	174-1972-00			CA ASSY,SP,ELEC:4,26 AWG,6.0 L,RIBBON	80009	174-1972-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3	671-1415-00			CIRCUIT BD ASSY:FRONT PANEL	80009	671-1415-00
A3C89	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A3C376	285-1461-00			CAP,FXD,PLSTC:0.022UF,10%,400V	TK1913	MKP10.02240010
A3C377	283-1045-00			CAP,FXD,MICA DI:15PF,0.5PF,500V	09023	CDA15CD150D03
A3C379	283-0768-00			CAP,FXD,MICA DI:132 PF,1%,500V	00853	D155F1320F0
A3C380	283-0643-00			CAP,FXD,MICA DI:22PF,0.5%,500V	00853	D105E220D0
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)
A3CR540	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR541	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A3CR542	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
A3DS915	150-1071-00			LT EMITTING DIO:GREEN,565NM,20MA MAX	80009	150-1071-00
A3J9006	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A3J9900	131-4522-00			CONN ASSY,ELEC:PROBE ADJUST,BRASS	TK1326	ORDER BY DESCR
A3Q550	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A3R89	322-3231-00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 2K49
A3R110	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A3R111	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A3R112	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R160	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A3R161	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A3R162	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R201	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A3R224	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A3R280	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R371	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A3R376	315-0620-00			RES,FXD,FILM:62 OHM,5%,0.25W	19701	5043CX63R00J
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	313-1130-00			RES,FXD,FILM:13 OHM,5%,0.2W	91637	CCF50-2-13R00J
A3R380	321-0459-00			RES,FXD,FILM:590K OHM,1%,0.125W,TC=T0	19701	5043ED590K0F
A3R401	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A3R438	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R519	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A3R520	313-1912-00			RES,FXD,FILM:9.1K OHM,5%,0.2W	57668	TR20 FXE 9.1K
A3R521	311-2428-00			RES,VAR,NONWW:50K OHM,20%,0.5W	01121	W8860
A3R538	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A3R539	313-1472-00			RES,FXD,FILM:4.7K OHM,5%,0.2W	57668	TR20JE 04K7
A3R546	313-1333-00			RES,FXD,FILM:33K OHM,5%,0.2W	57668	TR20JE 33K
A3R570	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A3R602	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R720	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E
A3R800	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A3R802	311-2427-01			RES,VAR,NONWW:10K,10%,0.25W,LINEAR (LOCATIONS A & B)	12697	CM45280
A3R810	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	57668	TR20JE 06K8
A3R882	311-2469-00			RES,VAR,NONWW:5K OHM,20%	50139	W8874
A3R910	313-1621-00			RES,FXD,FILM:620 OHM,5%,0.2W	57668	TR20JE 620E
A3R950	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A3R951	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A3R982	311-1227-00			RES,VAR,NONWW:TRMR,5K OHM,0.5W	32997	3386F-T04-502
A3R983	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A3R992	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A3R993	313-1220-00			RES,FXD,FILM:22 OHM,5%,0.2W	57668	TR20JE22E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A3S90	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S200	260-2111-00			SWITCH,PUSH:SPDT,MOMENTARY	59821	2LL199NB021085
A3S226	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S380	260-2033-03			SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S390	260-2111-00			SWITCH,PUSH:SPDT,MOMENTARY	59821	2LL199NB021085
A3S392	260-2419-00			SWITCH:DOUBLE POLE 4-POS	82104	51524 - SL
A3S401	260-2110-00			SWITCH,PUSH:1 SPDT/2 DPDT	59821	ORDER BY DESCR
A3S460	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S545	260-2033-03			SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S550	260-2033-03			SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3S555	260-2419-00			SWITCH:DOUBLE POLE 4-POS	82104	51524 - SL
A3S602	260-2075-00			SWITCH,PUSH:SPDT,50VDC,500M AMP	80009	260-2075-00
A3S648	260-2033-03			SWITCH,SLIDE:DPTT,125V,0.5A	95348	51523-SL
A3VR950	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A3VR951	152-0317-00			SEMICOND DVC,DI:ZEN,SI,6.2V,5%,0.4W,DO-35	04713	1N825
A3W90	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W91	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A3W2222	174-1968-00			CA ASSY,SP,ELEC:18,27 AWG,1.9 L	80009	174-1968-00
A3W2223	174-1968-00			CA ASSY,SP,ELEC:18,27 AWG,1.9 L	80009	174-1968-00
A3W9200	174-1959-00			CA ASSY,SP,ELEC:4,26 AWG,8.5 L,RIBBON	80009	174-1959-00
A3W9201	174-1959-00			CA ASSY,SP,ELEC:4,26 AWG,8.5 L,RIBBON	80009	174-1959-00
A3W9884	174-1379-00			CA ASSY,SP,ELEC:2,28 AWG,2.25 L	80009	174-1379-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4	671-1420-00			CIRCUIT BD ASSY:TIMING	80009	671-1420-00
A4C702	281-0764-00			CAP,FXD,CER DI:82PF,5%,100V	04222	MA101A820JAA
A4C703	281-0303-00			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	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
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
A4C712	281-0764-00			CAP,FXD,CER DI:82PF,5%,100V	04222	MA101A820JAA
A4C713	281-0303-00			CAP,VAR,CER DI:2.5-20PF,250V	80009	281-0303-00
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
A4C717	281-0768-00			CAP,FXD,CER DI:470PF,20%,100V	04222	MA101A471MAA
A4C720	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
A4C722	290-0246-00			CAP,FXD,ELCTLT:3.3UF,10%,15V	12954	D3R3EA15K1
A4C724	290-0136-00			CAP,FXD,ELCTLT:2.2UF,20%,20V	05397	T322B225M020AS
A4C728	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305SC474MAA
A4C737	281-0862-00	B011625		CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C102MAA
A4C749	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
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
A4C752	281-0775-01			CAP,FXD,CER DI:0.1UF,20%,50V	04222	SA105E104MAA
A4C762	281-0758-00			CAP,FXD,CER DI:15PF,20%,100V	04222	SA102A150MAA
A4CR730	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR731	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4CR740	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A4ID37	210-0413-00			NUT,PLAIN,HEX:0.375-32 X 0.5,BRS CD PL	73743	3145-402
A4P9201	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A4P9700	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A4P9705	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A4Q701	151-0424-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0424-00
A4Q704	151-1042-00			SEMICOND DVC SE:FET,SI,TO-92 (LOCATIONS A & B)	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	80009	151-0424-00
A4Q710	151-1042-00			SEMICOND DVC SE:FET,SI,TO-92 (LOCATIONS A & B)	80009	151-1042-00
A4Q712	151-0736-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0736-00
A4Q730	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q732	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A4Q737	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q740	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A4Q742	151-0712-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0712-00
A4Q745	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
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	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A4R705	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
A4R707	301-0202-00			RES,FXD,FILM:2K OHM,5%,0.5W	19701	5053CX2K000J
A4R709	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A4R710	322-3114-00			RES,FXD,FILM:150 OHM,1%,0.2W,TC=T0	57668	CRB20FX150EAXIAL
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	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K8
A4R716	322-3304-00			RES,FXD,FILM:14.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 14K3
A4R717	322-3304-00			RES,FXD,FILM:14.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 14K3
A4R718	322-3308-00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 15K8
A4R719	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A4R721	311-2151-00			RES,VAR,NONWW:PNL,500 OHM,20%,0,5W,DPST	12697	CM43499
A4R722	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A4R724	313-1200-00			RES,FXD,FILM:20 OHM,5%,0.2W	57668	TR20JE20E
A4R725	322-3271-00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0	91637	CCF502G64900FT
A4R727	322-3243-00			RES,FXD,FILM:3.32K OHM,1%,0.2W,TC=T0	80009	322-3243-00
A4R728	322-3208-00			RES,FXD,FILM:1.43K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K43
A4R729	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A4R730	311-2232-00			RES,VAR,NONWW:TRMR,2K OHM,20%,0.5W LINEAR	TK1450	GF06UT 2K
A4R731	322-3255-00			RES,FXD,FILM:4.42K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K42
A4R732	313-1123-00			RES,FXD,FILM:12K OHM,5%,0.2W	57668	TR20JE12K0
A4R733	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A4R734	322-3232-00			RES,FXD,FILM:2.55K OHM,1%,0.2W,TC=T0	80009	322-3232-00
A4R735	322-3271-00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0	91637	CCF502G64900FT
A4R737	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A4R738	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A4R739	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A4R740	311-2232-00			RES,VAR,NONWW:TRMR,2K OHM,20%,0.5W LINEAR	TK1450	GF06UT 2K
A4R741	322-3255-00			RES,FXD,FILM:4.42K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 4K42
A4R742	313-1123-00			RES,FXD,FILM:12K OHM,5%,0.2W	57668	TR20JE12K0
A4R743	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A4R744	322-3232-00			RES,FXD,FILM:2.55K OHM,1%,0.2W,TC=T0	80009	322-3232-00
A4R745	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A4R746	313-1621-00			RES,FXD,FILM:620 OHM,5%,0.2W	57668	TR20JE 620E
A4R747	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A4R748	322-3293-00			RES,FXD,FILM:11K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 11K0
A4R749	311-2234-00			RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W LINEARTAPE & REEL	TK1450	GF06UT 5K
A4R750	322-3293-00			RES,FXD,FILM:11K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 11K0
A4R751	322-3326-00			RES,FXD,FILM:24.3K OHM,1%,0.2W,TC-T0	91637	CCF50-2F24301F
A4R752	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A4R753	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	80009	322-3215-00
A4R754	311-0622-00			RES,VAR,NONWW:TRMR,100 OHM,0.5W	32997	3329H-L58-101
A4R755	313-1121-00			RES,FXD,FILM:120 OHM,5%,0.2W	80009	313-1121-00
A4R758	313-1333-00			RES,FXD,FILM:33K OHM,5%,0.2W	57668	TR20JE 33K
A4R759	322-3204-00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K30
A4R760	311-2229-00			RES,VAR,NONWW:TRMR,250 OHM,20%,0.5W LINEAR	TK1450	GF06UT 250
A4R761	322-3210-00			RES,FXD,FILM:1.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K50
A4R762	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A4RT715	307-0125-00			RES,THERMAL:500 OHM,10%,NTC	15454	1DB501K-220-EC
A4S701	260-2023-03			SWITCH,ROTORY:TIMING,A/B SWEEP	82104	ORDER BY DESCR
A4U715	156-1272-00			MICROCKT,LINEAR:DUAL OPERATIONAL AMPLIFIER	80009	156-1272-00
A4U750	156-1150-00			IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR;NEG 5V, 100MA;79L05A,TO-92	80009	156-1150-00
A4U760	155-0124-00			MICROCKT,LINEAR:HORIZ PREAMP	80009	155-0124-00
A4VR720	152-0195-00			SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4W,DO-7	80009	152-0195-00
A4VR749	152-0744-00			SEMICOND DVC,DI:ZEN,SI,3.6V,5%,0.4W,DO-7	80009	152-0744-00
A4W709	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.
A5	671-1422-00			CIRCUIT BD ASSY:ALT SWEEP	80009	671-1422-00
A5C605	281-0826-00			CAP,FXD,CER DI:2200PF,10%,100V	20932	401EM100AD222K
A5C606	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A5C610	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A5C641	290-0776-00			CAP,FXD,ELCTLT:22UF,+50-20 %,10V	55680	ULA1A220TAA
A5C643	281-0904-00			CAP,FXD,CER DI:12PF,10%	04222	MA101A120KAA
A5C655	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A5C657	281-0862-00			CAP,FXD,CER DI:0.001UF,+80-20%,100V	04222	MA101C10ZMAA
A5C659	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A5C665	281-0797-00			CAP,FXD,CER DI:15PF,10%,100V	04222	SA106A150KAA
A5C667	281-0759-00			CAP,FXD,CER DI:22PF,10%,100V	04222	MA101A220KAA
A5C670	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A5C672	281-0759-00	B010100	B011670	CAP,FXD,CER DI:22PF,10%,100V	04222	MA101A220KAA
A5C672	281-0785-00	B011671		CAP,FXD,CER DI:68PF,10%,100V	04222	MA101A680KAA
A5C680	281-0773-00			CAP,FXD,CER DI:0.01UF,10%,100V	04222	MA201C103KAA
A5CR625	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR680	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR684	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR685	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR687	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR816	152-0153-00			SEMICOND DVC,DI:SW,SI,10V,50MA,.DO-7	07263	FD7003
A5CR817	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5CR826	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	03508	DA2527 (1N4152)
A5L667	108-1485-00			COIL,RF:FXD,INDUCTOR,220UH,10%,0.41A,BOBBIN CORE,RADIAL LEAD 0.2 IN LEAD SPACING,	TK2058	TSL0707-221KR41
A5P2100	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A5P2200	131-0589-00			TERM,PIN:0.46 L X 0.025 SQ PH BRZ GLD PL	22526	48283-029
A5P9400	136-1088-00			SKT,PL-IN ELEK:1 X 15,RITHY ANGLE	80009	136-1088-00
A5Q630	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A5Q631	151-0199-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0199-00
A5Q637	151-0276-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0276-00
A5Q643	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A5Q670	151-0188-05			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-05
A5Q674	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A5Q682	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A5Q683	151-0188-00			TRANSISTOR:PNP,SI,TO-92	80009	151-0188-00
A5Q684	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A5Q687	151-0190-00			TRANSISTOR:NPN,SI,TO-92	80009	151-0190-00
A5R604	322-3180-00			RES,FXD,FILM:732 OHM,1%,0.2W,TC=T0	80009	322-3180-00
A5R605	322-3141-00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 287E
A5R606	322-3197-00			RES,FXD,FILM:1.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K10
A5R609	313-1222-00			RES,FXD,FILM:2.2K OHM,5%,0.2W	57668	TR20JE 02K2
A5R610	313-1241-00			RES,FXD,FILM:240 OHM,5%,0.2W	57668	TR20JE 240E
A5R611	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A5R613	322-3097-00			RES,FXD,FILM:100 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100E
A5R614	322-3130-00			RES,FXD,FILM:221 OHM,1%,0.2W,TC=T0	80009	322-3130-00
A5R616	322-3145-00			RES,FXD,FILM:316 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 316E
A5R617	322-3182-00			RES,FXD,FILM:768 OHM,1%,0.2W,TC=T0	80009	322-3182-00
A5R618	322-3141-00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 287E
A5R619	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	80009	322-3215-00
A5R621	322-3215-00			RES,FXD,FILM:1.69K OHM,1%,0.2W,TC=T0	80009	322-3215-00
A5R623	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A5R624	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A5R625	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R626	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R627	311-2273-00			RES,VAR,NONWW:TRMR,2K OHM,20%,0.5W	80009	311-2273-00
A5R628	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R630	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
A5R631	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A5R632	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A5R633	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A5R634	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A5R635	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	57668	TR20JE 47E
A5R637	322-3385-00			RES,FXD,FILM:100K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 100K
A5R638	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R640	313-1114-00			RES,FXD,FILM:110K,5%,0.2W	57668	TR20JE110K
A5R642	322-3314-00			RES,FXD,FILM:18.2K OHM,1%,0.2W,TC=T0	80009	322-3314-00
A5R643	322-3322-00			RES,FXD,FILM:22.1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 22K1
A5R644	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R650	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R651	322-3277-00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A5R652	311-2271-00			RES,VAR,NONWW:TRMR,5K OHM,20%,0.5W	80009	311-2271-00
A5R653	322-3289-00			RES,FXD,FILM:10K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 10K0
A5R659	313-1221-00			RES,FXD,FILM:220 OHM,5%,0.2W	57668	TR20JE220E
A5R660	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A5R662	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A5R663	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R664	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	57668	TR20JE 03K9
A5R665	313-1513-00			RES,FXD,CMPSN:51K OHM,5%,0.2W	57668	TR20JE 51K
A5R667	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A5R668	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R669	313-1512-00			RES,FXD,FILM:5.1K OHM,5%,0.2W	57668	TR20JE 5K1
A5R670	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R671	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R672	313-1331-00			RES,FXD,FILM:330 OHM,5%,0.2W	57668	TR20JE 330E
A5R674	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R675	322-3193-00			RES,FXD,FILM:1K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K00
A5R678	322-3163-00			RES,FXD,FILM:487 OHM,1%,0.2W,TC=T0	91637	CCF50-2G487R0F
A5R679	322-3126-00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0	91637	CCF501G200R0F
A5R682	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A5R683	313-1431-00			RES,FXD,FILM:430 OHM,5%,0.2W	57668	TR20JE 430E
A5R684	313-1331-00			RES,FXD,FILM:330 OHM,5%,0.2W	57668	TR20JE 330E
A5R686	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A5R687	313-1331-00			RES,FXD,FILM:330 OHM,5%,0.2W	57668	TR20JE 330E
A5R688	313-1181-00			RES,FXD,FILM:180 OHM,5%0.2W	57668	TR20JE180E
A5R689	313-1471-00			RES,FXD,FILM:470 OHM,5%,0.2W	57668	TR20JE 470E
A5R816	313-1562-00			RES,FXD,FILM:5.6K OHM,5%,0.2W	57668	TR20JE 05K6
A5R817	313-1302-00			RES,FXD,FILM:3K OHM,5%,0.2W	57668	TR20JE 03K0
A5U605	234-0107-20			INTEGRATED CKT:SCHMITT TRIGGER	80009	234-0107-20
A5U655	156-1126-00			MICROCKT,LINEAR:VOLTAGE COMPARATOR	80009	156-1126-00
A5U660	156-0385-00			IC,DIGITAL:LSTTL,GATES;HEX INV;74LS04,DIP14 .3,TUBE	80009	156-0385-00
A5U665	156-0382-00			IC,DIGITAL:LSTTL,GATES;QUAD 2-INPUT NAND;74 LS00,DIP14.3,TUBE	80009	156-0382-00
A5U670	156-1639-00			IC,DIGITAL:ECL,FLIP FLOP;DUAL MASTER-SLAVE; 10H131,DIP16.3	80009	156-1639-00
A5U680	156-0382-00			IC,DIGITAL:LSTTL,GATES;QUAD 2-INPUT NAND;74 LS00,DIP14.3,TUBE	80009	156-0382-00
A5VR660	152-0195-00			SEMICOND DVC,DI:ZEN,SI,5.1V,5%,0.4W,DO-7	80009	152-0195-00
A5W637	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W638	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W643	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W655	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W672	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W674	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.
A5W678	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W682	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W689	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W690	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W691	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W695	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA 07
A5W696	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	670-7615-01			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	285-1191-00			CAP,FXD,PLASTIC:0.012 UF,5%,1000V	14752	C-2524
A6C903	285-1191-00			CAP,FXD,PLASTIC:0.012 UF,5%,1000V	14752	C-2524
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	301-0131-00			RES,FXD,FILM:130 OHM,5%,0.5W	19701	5053CX130R0J
A6RT901	307-0863-00			RES,THERMAL:10 OHM,10%,NTC	15454	SG-13S
A6RV901	307-0456-00			RES,V SENSITIVE:250VAC,20W,METAL OXIDE	03508	MOV-V250LA15A
A6T901	120-1449-00			TRANSFORMER,RF:COMMON MODE,2.7MH,2A	80009	120-1449-00
A6T903	120-1455-00			TRANSFORMER,RF:DIFFERENTIAL MODE,POT CORE	64053	120-1455-00
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.
A7	671-1463-00			CIRCUIT BD ASSY:SCALE ILLUM	80009	671-1463-00
A7DS881	150-0077-01			LAMP,INCAND:14V,0.08A,#2282D,WIRE LEADS	08806	2162D
A7DS882	150-0077-01			LAMP,INCAND:14V,0.08A,#2282D,WIRE LEADS	08806	2162D
A7W9882	174-1379-00			CA ASSY,SP,ELEC:2,28 AWG,2.25 L	80009	174-1379-00

Component No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Name & Description	Mfr. Code	Mfr. Part No.
DL9210	119-1515-00			DELAY LINE,ELEC:93NS,150 OHM,ASSEMBLY	80009	119-1515-00
F9001	159-0041-00			FUSE,CARTRIDGE:3AG,1.25A,250V,20SEC	71400	MSL 1 1/4
V9870	154-0861-10			ELECTRON TUBE:T4655-31-2	80009	154-0861-10

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols

Graphics symbols and class designation letters are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI/IEEE 91-1984. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The (L) after a signal name indicates that the signal performs its intended function when it is in the LO 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.
Y14.2M-1979	Line Conventions and Lettering.

ANSI/IEEE 280-1985 Letter Symbols for Quantities Used in Electrical Science and Electrical Engineering.

American National Standards Institute
1430 Broadway
New York, New York 10018

Component Values

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

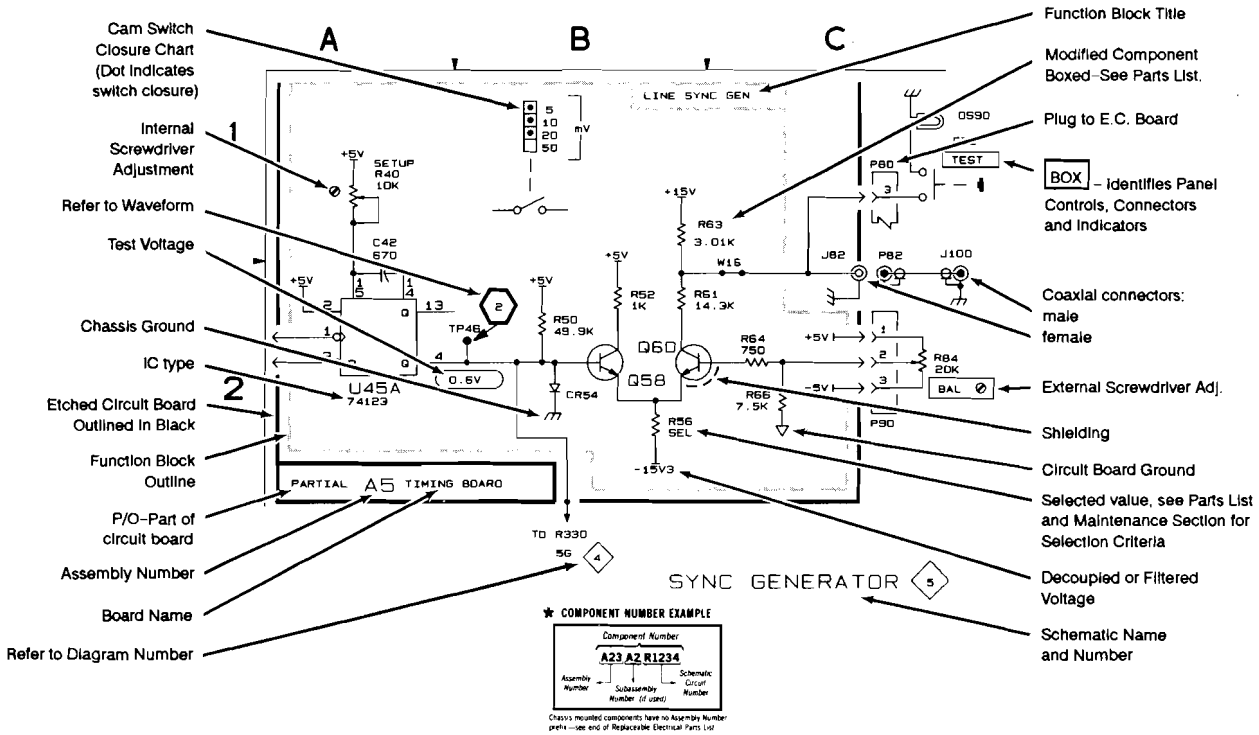
Capacitors	Values one or greater are in picofarads (pF). Values less than one are in microfarads (μF).
Resistors	Ohms (Ω).

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

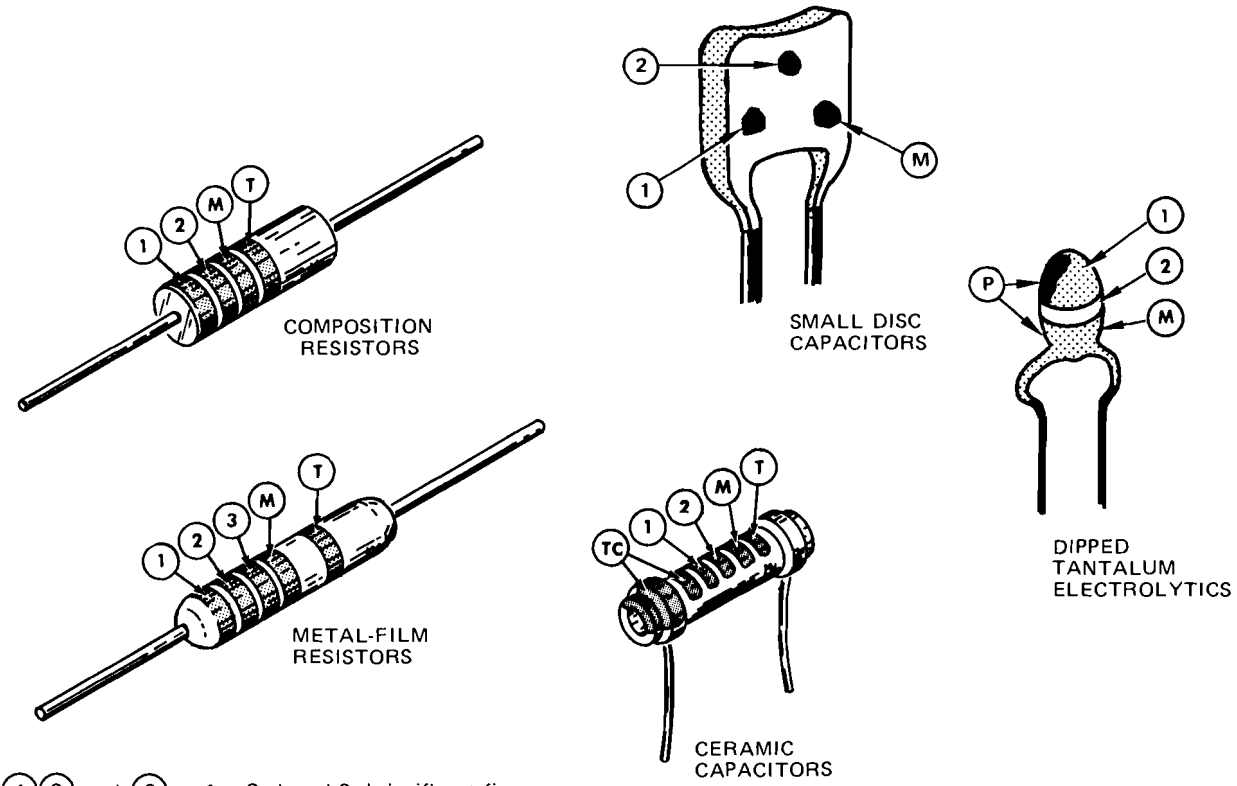
Assembly Numbers and Grid Coordinates

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 illustrations have grids. A lookup table with the grid coordinates is provided for ease of locating the component. Only the components illustrated on the facing diagram are listed in the lookup table. When more than one schematic diagram is used to illustrate the circuitry on a circuit board, the circuit board illustration may only appear opposite the first diagram on which it was illustrated; the lookup table will list the diagram number of other diagrams that the circuitry of the circuit board appears on.



COLOR CODE



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

(M) –multiplier (T) –tolerance

(TC) –temperature coefficient

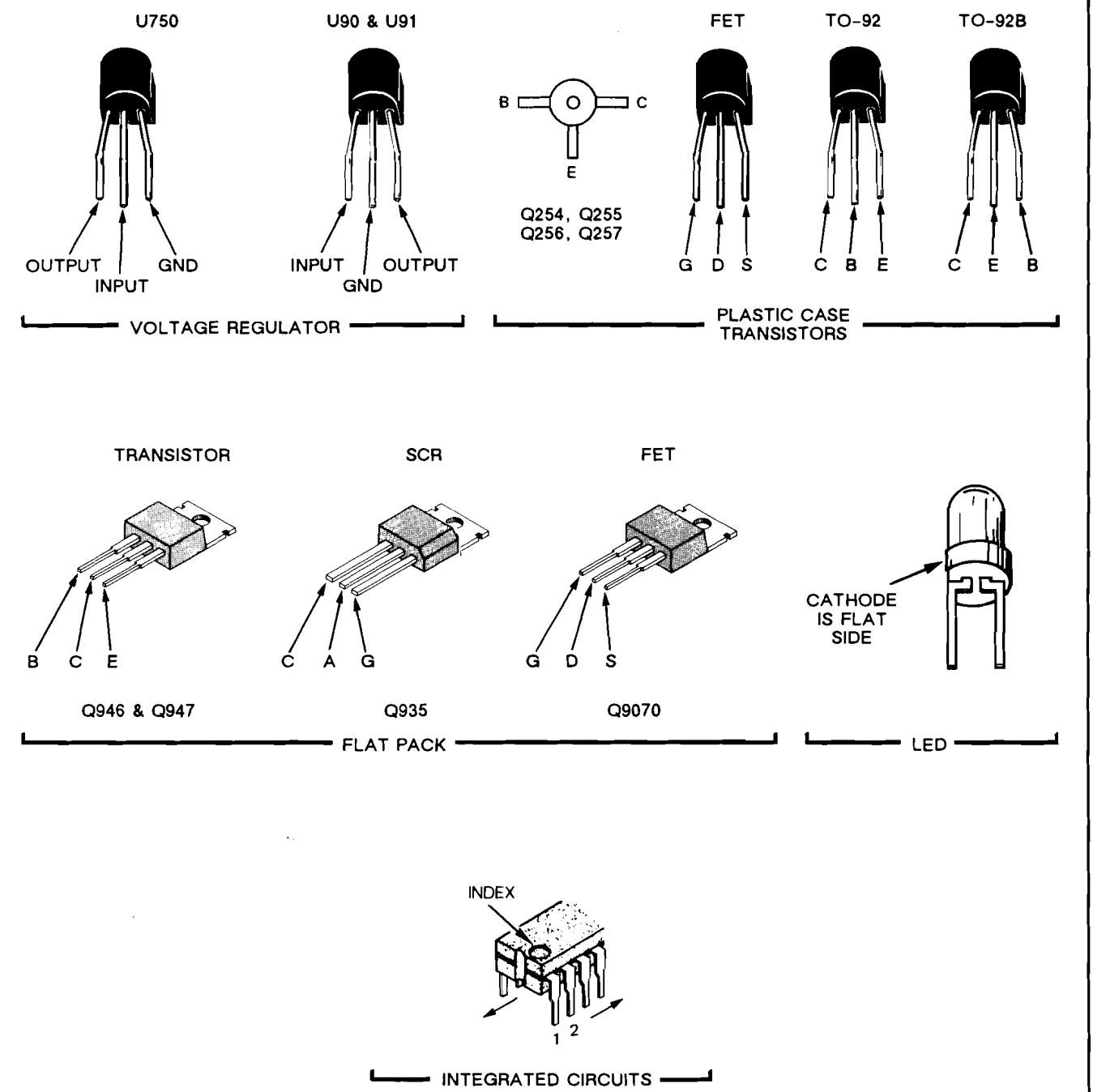
(P) –polarity and voltage rating

(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)4206-31

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



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

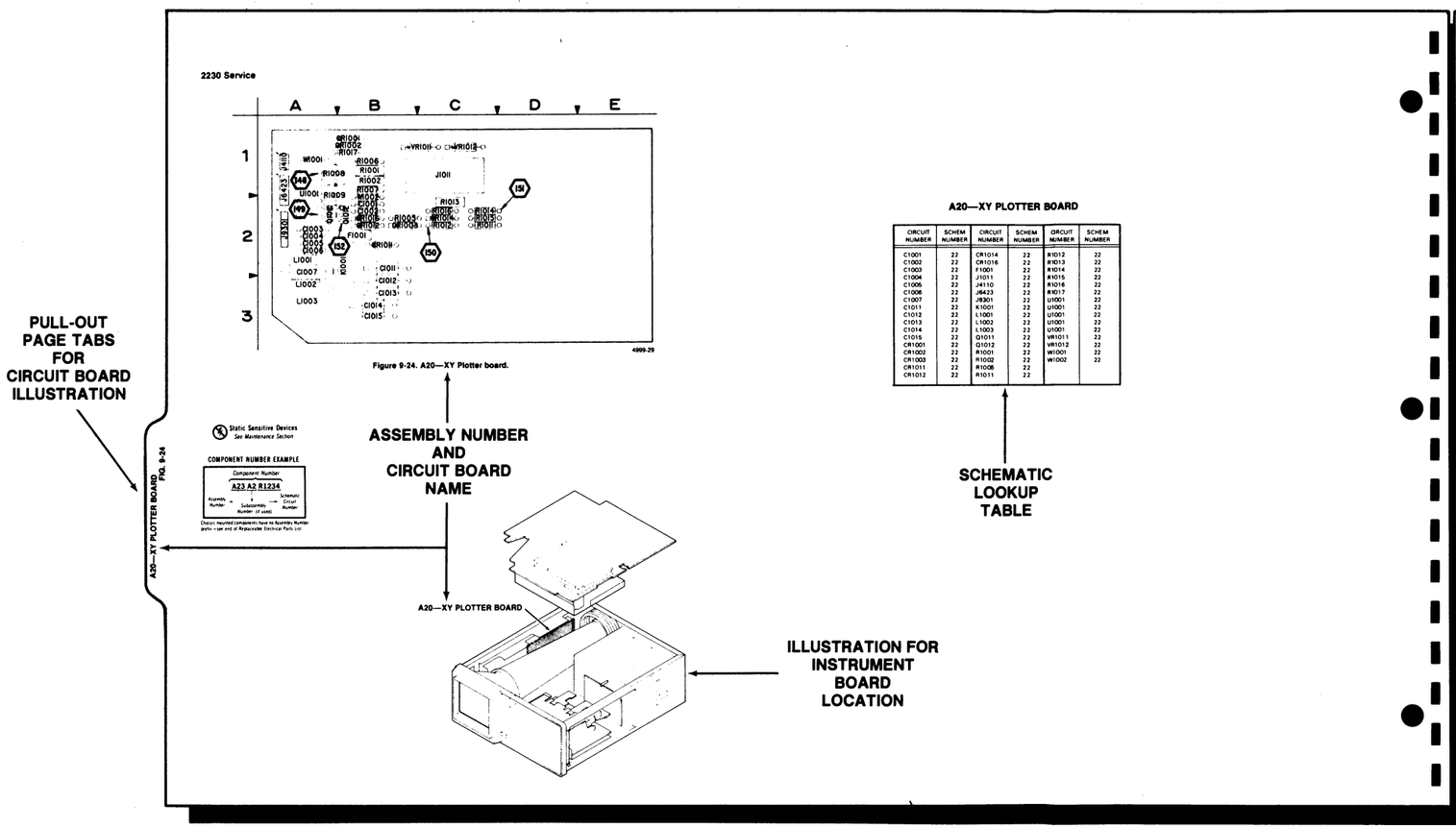
(7685-50)7683-31

Figure 9-2. Semiconductor lead configurations.

2235A Instruction

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

1. Locate the Circuit Board Illustration.
   a. Identify the Assembly Number of the circuit board that the component is on by using the Circuit Board location illustration in this section or the mechanical parts exploded views at the rear of this manual.
   b. In the manual, locate the tabbed foldout page that corresponds with the Assembly Number of the circuit board. The circuit board assembly numbers and names are printed on the back side of the tabs (facing the rear of the manual).
2. Determine the Circuit Number and Schematic Diagram.
   a. Compare the circuit board with its illustration. Locate the component you are looking for by area and shape on the illustration to determine its Circuit Number.
   b. Scan the lookup table next to the Circuit Board illustration to find the Circuit Number of the component.
   c. Read the SCHEM NUMBER column next to the component's circuit number to find the Schematic Diagram number.
3. Locate the Component on the Schematic Diagram.
   a. Locate the tabbed page that corresponds to the Schematic Diagram ber. Schematic diagram numbers and names are printed on the front of the tabs (facing the front of the manual).
   b. Locate the Assembly Number in the Component Location lookup next to the schematic diagram. Scan the CIRCUIT NUMBER colum that table to find the Circuit Number of the component you are lookin in the schematic.



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

1. Determine the Circuit Board Illustration and Component Location.
   a. From the schematic diagram, determine the Assembly Number of the circuit board that the component is on. The Assembly Number and Name is boxed and located in a corner of the heavy line marking the circuit board outline in the schematic diagram.
   b. Find the Component Location table for the Assembly Number found on the schematic. Scan the CIRCUIT NUMBER column to find the Circuit Number of the component.
   c. Look in the BOARD LOCATION column next to the component number and read its circuit board grid coordinates.
2. Locate the Component on the Circuit Board.
   a. In the manual, locate the tabbed page that corresponds to Assembly Number the component is on. Assembly numbers and names for circuit boards are on the back side of the tabs.
   b. Using the Circuit Number of the component and its given grid location, find the component in the Circuit Board illustration.
   c. From the small circuit board location illustration shown next to the circuit board, find the circuit board's location in the instrument.
   d. Find the circuit board in the instrument. Compare it with the circuit board illustration in the manual to locate the component on the circuit board itself.

Figure 9-3. Locating components on schematic diagrams and circuit board illustrations.

2. Determine the Circuit Number and Schematic Diagram.

   a. Compare the circuit board with its illustration. Locate the component you are looking for by area and shape on the illustration to determine its Circuit Number.

   b. Scan the lookup table next to the Circuit Board illustration to find the Circuit Number of the component.

   c. Read the SCHEM NUMBER column next to the component's circuit number to find the Schematic Diagram number.

3. Locate the Component on the Schematic Diagram.

   a. Locate the tabbed page that corresponds to the Schematic Diagram number. Schematic diagram numbers and names are printed on the front side of the tabs (facing the front of the manual).

   b. Locate the Assembly Number in the Component Location lookup table next to the schematic diagram. Scan the CIRCUIT NUMBER column of that table to find the Circuit Number of the component you are looking for in the schematic.

   c. In the SCHEM LOCATION column next to the component, read the grid coordinates of the component in the schematic.

   d. Using the grid coordinates given, find the component in the schematic diagram.

A20—XY PLOTTER BOARD

SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
22	CR1014	22	R1012	22
22	CR1016	22	R1013	22
22	F1001	22	R1014	22
22	J1011	22	R1015	22
22	J4110	22	R1016	22
22	J6423	22	R1017	22
22	J9301	22	U1001	22
22	K1001	22	U1001	22
22	L1001	22	U1001	22
22	L1002	22	U1001	22
22	L1003	22	U1001	22
22	Q1011	22	VR1011	22
22	Q1012	22	VR1012	22
22	R1001	22	W1001	22
22	R1002	22	W1002	22
22	R1006	22		
22	R1011	22		

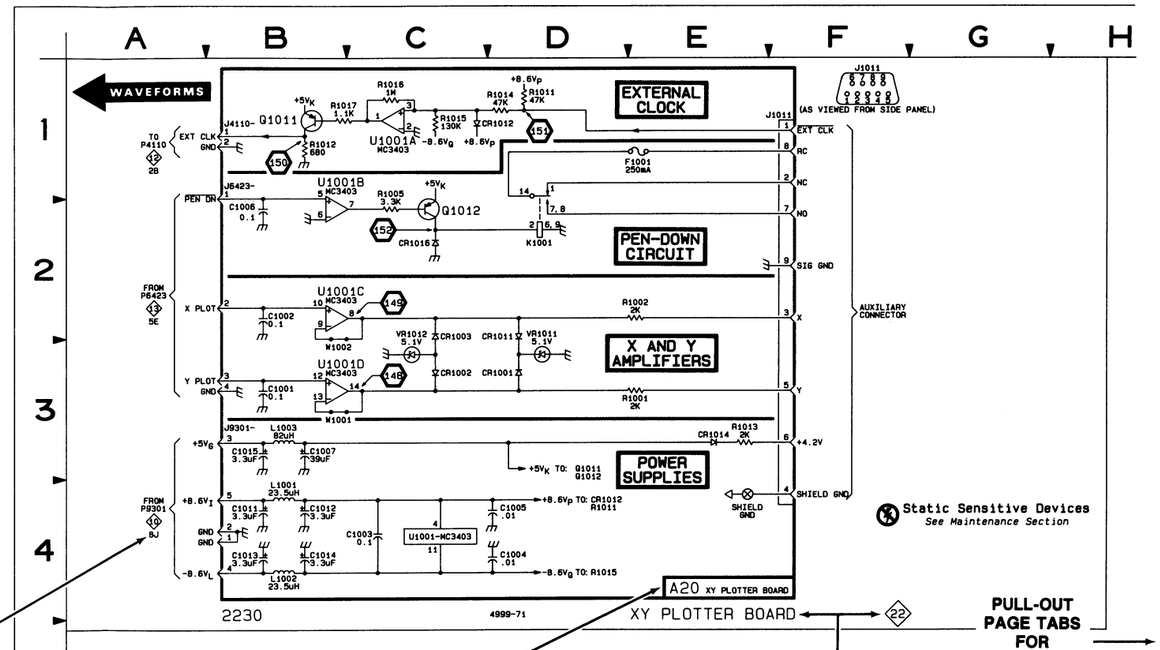
SCHEMATIC LOOKUP TABLE

XY PLOTTER BOARD DIAGRAM 22

ASSEMBLY A20

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C1001	3B	2B	F1001	1E	2B	R1012	1B	2C
C1002	2B	2B				R1013	3E	2C
C1003	4C	2A	J1011	1F	1C	R1014	1D	2C
C1004	4D	2A	J4110	1B	1A	R1015	1C	2C
C1005	4D	2A	J6423	1B	1A	R1016	1C	2C
C1006	2B	2A	J9301	3B	2A	R1017	1B	1B
C1007	3B	2A						
C1011	4B	2B	K1001	2D	2B	U1001A	1C	1A
C1012	4B	3B				U1001B	2B	1A
C1013	4B	3B	L1001	4B	2A	U1001C	2B	1A
C1014	4B	3B	L1002	4B	3A	U1001D	3B	1A
C1015	3B	3B	L1003	3B	3A	U1001	4C	1A
CR1001	3D	1B	Q1011	1B	2A	VR1011	3D	1C
CR1002	3C	1B	Q1012	2C	2B	VR1012	3C	1C
CR1003	2C	2B						
CR1011	2D	2B	R1001	3E	1B	W1001	3B	1A
CR1012	1C	2B	R1002	2E	1B	W1002	3B	2B
CR1014	3E	2C	R1005	2C	2B			
CR1016	2C	2B	R1011	1D	2C			

COMPONENT LOCATION TABLE



NUMERAL AND LETTER AT SIGNAL LINES TO OR FROM OTHER DIAGRAMS INDICATES THE GRID COORDINATES ON ANOTHER SCHEMATIC (FOR EXAMPLE: 8J)

ASSEMBLY NUMBER AND NAME

SCHEMATIC DIAGRAM NAME AND NUMBER

PULL-OUT PAGE TABS FOR SCHEMATIC DIAGRAMS

2. Locate the Component on the Circuit Board.

   a. In the manual, locate the tabbed page that corresponds to Assembly Number the component is on. Assembly numbers and names for circuit boards are on the back side of the tabs.

   b. Using the Circuit Number of the component and its given grid location, find the component in the Circuit Board illustration.

   c. From the small circuit board location illustration shown next to the circuit board, find the circuit board's location in the instrument.

   d. Find the circuit board in the instrument. Compare it with the circuit board illustration in the manual to locate the component on the circuit board itself.

Figure 9-3. Locating components on schematic diagrams and circuit board illustrations.

S1
AC-GND-DC
CH 1
VOLTS/DIV
S10
R43
CAL
CH 1 OR X
CH 2 OR Y
CH1 HIGH-Z ATTENUATOR AND INPUT COUPLING
CH1 BUFFER AMPL U10, G13, G15, G18
CH1 LOW-Z ATTENUATOR R19
CH1 PARAPHASE AMPL U30
CH2 HIGH-Z ATTENUATOR AND INPUT COUPLING
CH2 BUFFER AMPL U60, G63, G65, G68
CH2 LOW-Z ATTENUATOR R69
CH2 PARAPHASE AMPL U80
1 CH 1 AND CH 2 ATTENUATORS
AC-GND-DC
S51
CH 2
VOLTS/DIV
S60
CAL
R93
INVERT
S90
±CH1_SIG
2
± CH2_SIG
S550
VERTICAL MODE
S545
CH1
BOTH
CH2
ADD
ALT
CHOP
CHOP
CHOP OSC AND CHOP BLANKING U537B, C, D, U540B
CHANNEL SWITCH LOGIC U537A, U540A
R112
CH 1 POSITION
CH1 PREAMP Q102, Q103, Q114, Q115, U120A, B, U130
*CH1_TRIG
*CH2_TRIG
CH2 PREAMP Q152, Q153, Q164, Q165, U120C, D, U180
CH 2 POSITION
R162
S200
TRIG VIEW
CHANNEL SWITCH CR200, CR201, CR202, CR203, Q440, Q441
VERTICAL PREAMPS AND SWITCHING
2
VERTICAL OUTPUT AMPLIFIER
3
DELAY LINE DRIVER Q202, Q203, Q206, Q2707, U225, DL9210
VERTICAL OUTPUT AMPL Q230, Q231, Q254, Q255, Q256, Q257
A/B SWP SEP Q283, Q284, Q285
A/B SWP SEP
R280
CR226, CR227, CR228, CR229
BW LIMIT
S226
S555
A & B SOURCE
S392
A COUPL
EXT INPUT
S380
A EXT COUPL
TRIGGER SWITCHING LOGIC Q400, Q550, U555, U565C, D
A EXTERNAL TRIGGER AMPL Q381, Q382A, B, Q384
CH 2 TRIGGER AMPLIFIER Q327, Q328, U335
CH 1 TRIGGER AMPLIFIER Q302, Q303, U310
A TRIGGER SWITCHING Q392, Q399
INTERNAL TRIGGER AMPLIFIER U350
INT TRIG
LINE TRIGGER BUFFER Q397
TRIGGER SELECT
4
+VERT DEF
-VERT DEF
R721
SEC/DIV VAR
B_SIGNAL
A_TRIGGER
P_P(L), TV_TRIG_ENABLE
2
S401
A TRIGGER MODE
R9521
VAR HOLDOFF
A SWEEP GENERATOR AND LOGIC
6
HOLDOFF TIMING Q7470, Q7471 Q7472, U504B
A TIMING SWITCH AND RC
VAR U715B
A END OF SWEEP COMPARATOR Q525
A_SWP
AUTO BASELINE Q501, Q509, U502, U532D
HOLDOFF
ALT_SYNC
XY INVERTER Q555
A SWEEP LOGIC U504A, U506, U532A Q511, Q576, Q578
ALT_SYNC
A_GATE (L)
A MILLER SWEEP Q701, Q706 Q704A, B
A_GATE
SEP (L)
LINE TRIGGER
S390
BEAM
UNBLANKING LOGIC CR551, Q583, Q586
Z-AXIS Q825, Q82 Q840,
POWER INPUT S901, VR901, F9001, CR901, CR902, CR903, CR904
FL9001
X_AXIS
S648
HORIZ MODE
A
B
ALT
A_ONLY (L)
B_ONLY (L)
HALT
ALTERNATE DISPLAY SWITCHING Q670, Q674, Q682, Q683, Q684, Q687, U660E, U665B, C, U670B, U680A, B
B DELAY TIME POSITION
R9644
DELAY TIME POSITION COMPARATOR Q64, U655
B SWEEP LOGIC U660A, B, F, U670A, U680C, D, Q630, Q631
B END OF SWEEP COMPARATOR Q643, U665A, D
B_SIGNAL
B TRIGGER LEVEL COMPARATOR AND SCHMITT TRIGGER U605
B TRIGGER SLOPE
S602
B TRIGGER LEVEL
R602
RUN AFTER DLY U660D, Q637
B MILLER SWEEP Q709, Q710A, B Q712
B HORIZ Z-AXIS LOGIC U665B
B TIMING SWITCH AND RC
B TIMING AND ALTERNATE B SWEEP
7
HORIZONTAL
R726
POSITION
X10 PULL
A_SWEEP
A_DISP
B_DISP
B_SWEEP
XY AMPLIFIER U715A
HORIZ PREAMP Q730, Q732, Q737, Q740, Q742, Q745, U760
+
-
CALIBRATOR, AND HORIZONTAL OUTPUT AMPLIFIER
8
HORIZ OUTPUT AMPLIFIER Q768, Q770, Q775, Q778, Q779, Q780, Q785, Q789
+HORIZ DEFL
-HORIZ DEFL
CALIBRATOR U985
CAL

R112 CH 1 POSITION
S200 TRIG VIEW
S555 A & B SOURCE
S392 A COUPL
EXT INPUT
S380 A EXT COUPL
S460 A TRIGGER SLOPE
R438 A TRIGGER LEVEL
2
CH1
BOTH
CH2
ADD
ALT
CHOP
CHOP
2
CHANNEL SWITCH LOGIC U537A, U540A
CHOP OSC AND CHOP BLANKING U537B, C, D, U540B
CH1 PREAMP Q102, Q103, Q114, Q115, U120A, B, U130
CH2 PREAMP Q152, Q153, Q164, Q165, U120C, D, U180
*CH1_TRIG
*CH2_TRIG
CHANNEL SWITCH CR200, CR201, CR202, CR203, Q440, Q441
VERTICAL PREAMPS AND SWITCHING 2
VERTICAL OUTPUT AMPLIFIER 3
DELAY LINE DRIVER Q202, Q203, Q206, Q2707, U225, DL9210
A/B SWP SEP Q283, Q284, Q285
VERTICAL OUTPUT AMPL Q230, Q231, Q254, Q255, Q256, Q257
CR226, CR227, CR228, CR229
TRIGGER SWITCHING LOGIC Q400, Q550, U555, U565C, D
CH 2 TRIGGER AMPLIFIER Q327, Q328, U335
CH 1 TRIGGER AMPLIFIER Q302, Q303, U310
A EXTERNAL TRIGGER AMPL Q381, Q382A, B, Q384
A TRIGGER SWITCHING Q392, Q399
INTERNAL TRIGGER AMPLIFIER U350
INT TRIG
LINE TRIGGER BUFFER Q397
TRIGGER SELECT 4
A TRIGGER LEVEL COMPARATOR Q446, Q450, U460
A TRIGGER LF REJECT Q402, Q405, Q406
TV TRIGGER Q473, Q474, Q487
P-P AUTO TRIGGER LEVEL Q413, Q420, Q421, Q422, Q423, Q428, Q429, U426
TRIGGER P-P AUTO AND OUTPUT 5
P-P AUTO
SEC/DIV VAR
VAR U715B
CH 2 POSITION R162
A/B SWP SEP R280
BW LIMIT S226
+VERT DEF
-VERT DEF
TV TRIG ENABLE
MILLER SWEEP Q706 D4A, B
SEP (L)
LINE TRIGGER
S390 BEAM FIND
R9812, R9802 INTENSITY
R893 FOCUS
FOCUS CONTROL Q885
FOCUS GRID
INTENSITY GRID
UNBLANKING LOGIC CR551, Q583, Q586
Z-AXIS AMPL Q825, Q829, Q835, Q840, Q845
INTENSITY Q804, Q814
DC RESTORER
HV MULTIPLIER U975
+43 V
XFMR T948
FL9001
POWER INPUT S901, VR901, F9001, CR901, CR902, CR903, CR904
PREREGULATOR Q908, Q928, Q930, Q9070, U930
INVERTER Q938, Q939, Q944, Q946, Q947
LV POWER SUPPLIES
LV TO ALL BLOCKS
Z-AXIS AMPLIFIER AND POWER SUPPLY 9 10
SCALE ILLUM Q82, U882
SCALE ILLUM R882
X_AXIS
ALTERNATE DISPLAY SWITCHING Q670, Q674, Q682, Q683, Q684, Q687, U660E, U665B, C, U670B, U680A, B
B HORIZ Z-AXIS LOGIC U665B
B TIMING SWITCH AND RC
B TIMING AND ALTERNATE B SWEEP 7
XY AMPLIFIER U715A
HORIZONTAL R726 POSITION
HORIZ PREAMP Q730, Q732, Q737, Q740, Q742, Q745, U760
A_SWEEP
A_DISP
B_DISP
B_SWEEP
X10 PULL
CALIBRATOR, AND HORIZONTAL OUTPUT AMPLIFIER 8
HORIZ OUTPUT AMPLIFIER Q768, Q770, Q775, Q778, Q779, Q780, Q785, Q789
+HORIZ DEFL
-HORIZ DEFL
CALIBRATOR U985
CAL

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Figure 9-4. 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
MODE	CH 1
BW LIMIT	Off (button out)
INVERT	Off (button out)
VOLTS/DIV	0.5 V
VOLTS/DIV Variable	CAL detent
Input Coupling	GND

Horizontal

POSITION	Midrange
MODE	A
A and B SEC/DIV	0.5 ms
SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
B DELAY TIME POSITION	0.5 ms

B TRIGGER

SLOPE	Positive (button out)
LEVEL	Midrange

A TRIGGER

VAR HOLDOFF	NORM
Mode	P-P AUTO
SLOPE	Positive (button out)
LEVEL	Midrange
A & B SOURCE	VERT MODE
A COUPL	NORM

Changes to the control settings for specific waveforms are noted at the beginning of each set of waveforms. Input signals and hookups required are also indicated, if needed, for each set of waveforms.

DC VOLTAGE MEASUREMENTS

Typical voltage measurements, located on the schematic diagram, were obtained with the instrument operating under the conditions specified in the Waveforms Measurements setup. Control-setting changes required for specific voltages are indicated on each waveforms page. Measurements are referenced to chassis ground with the exception of the preregulator and inverter voltages on Diagram 9. These voltages are referenced as indicated on the schematic diagram.

RECOMMENDED TEST EQUIPTMENT

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 isolate 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 isolte that supply, it is very probable that a short exits 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 resistanve values.

OTHER PARTS

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION
B1	D10	5G	J9376	D04	3A	Q9070	D09	3F
F9001	D09	1A	J9510	D01	4A	R9644	D07	3B
FL9001	D09	1A	J9800	D10	1B	V9870	D10	2G
J9100	D01	2A						

P9103 (A1) to W9103 (A2)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	GND	2, 1B	1, 2H
2	-CH1_SIG	2, 2B	1, 2H
3	+CH1_SIG	2, 1B	1, 3H
4	GND	2, 2B	1, 2H

P9108 (A1) to W9108 (A2)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	GND	2, 3B	1, 4H
2	-CH2_SIG	2, 4B	1, 4H
3	+CH2_SIG	2, 3B	1, 4H
4	GND	2, 4B	1, 4H

J2222 (A1) to W2222 (A3)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	SCALE_ILLUM	10, 4B	
2	GND	11, 2G	
3	A_INTENS	10, 2B	
4	B_INTENS	10, 2B	
5	BEAM_FIND	10, 3B	
6	CH1_POS	2, 1C	
7	A/B_SWP_SEP	3, 2D	
8	+8.6VH	11, 2G	
9	TRIG_VIEW	2, 5B	
10	CH2_POS	2, 3C	
11	CH2(L)	2, 5B	
12	BW_LIMIT	3, 2D	
13	-8.6VH	11, 2G	
14	VALT1(L)	4, 3C	
15	CH1(L)	2, 4B	
16	A_ONLY(L)	7, 2B	
17	B_LEVEL	7, 5D	
18	TV_TRIG_ENABLE	6, 4B	

J2223 (A1) TO W2223 (A3)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	NOT USED	5, 2G	
2	A_SLOPE	5, 5B	
3	A_LEVEL	5, 2G	
4	+AUTO_LEVEL	5, 2G	
5	-AUTO_LEVEL	5, 2G	
6	P-P(L)	6, 4B	
7	SS_RESET	6, 3B	
8	B_ONLY(L)	7, 2B	
9	B_SLOPE	7, 5D	
10	TRIG'D_LED	6, 5F	
11	SS(L)	6, 5B	
12	HF_REJ	4, 2C	
13	LF_REJ	4, 2C	
14	GND	4, 2C	
15	NOT USED	4, 2C	
16	NOT USED	4, 2C	
17	GND	4, 2C	
18	EXT_INPUT	4, 3C	

P9700 (A4) to W9700 (A1)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	A_DISP	8, 3B	
2	B_DISP	8, 3B	
3	B_SWP	7, 3C	
4	NOT USED	6, 3C	
5	NOT USED	6, 3D	
6	NOT USED	6, 3C	
7	A_SWP	6, 4H	
8	A_GATE2(L)	6, 2G	
9	GND	11, 1G	
10	B_RETRACE	7, 4C	

P9705 (A4) to W9705 (A1)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	GND	8, 4B	11, 2G
2	-SWP	8, 3E	
3	+SWP	8, 4E	
4	GN	8, 5B	11, 2G
5	X_AXIS_SIG	8, 2B	
6	$-8.6V_c$	8, 5B	11, 2G
7	$+8.6V_b$	8, 4B	11, 2G
8	$+30V_b$	8, 4B	11, 1G

P9991 (A1) to W9991 (A2)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	$+8.6V_b$	1, 4A	11, 5G
2	GND	1, 4A	11, 5G
3	CH 1_ PROBE_CODE	1, 1A	1, 1A
4	$-8.6V_c$	1, 5A	11, 5G

P9200 (A2) to W9200 (A3)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	NOT USED	1, 3H	1, 3H
2	INVERT	1, 5E	1, 5E
3	NORMAL	1, 5E	1, 5E
4	NOT USED	1, 5H	1, 5H

P9201 (A4) to W9201 (A3)

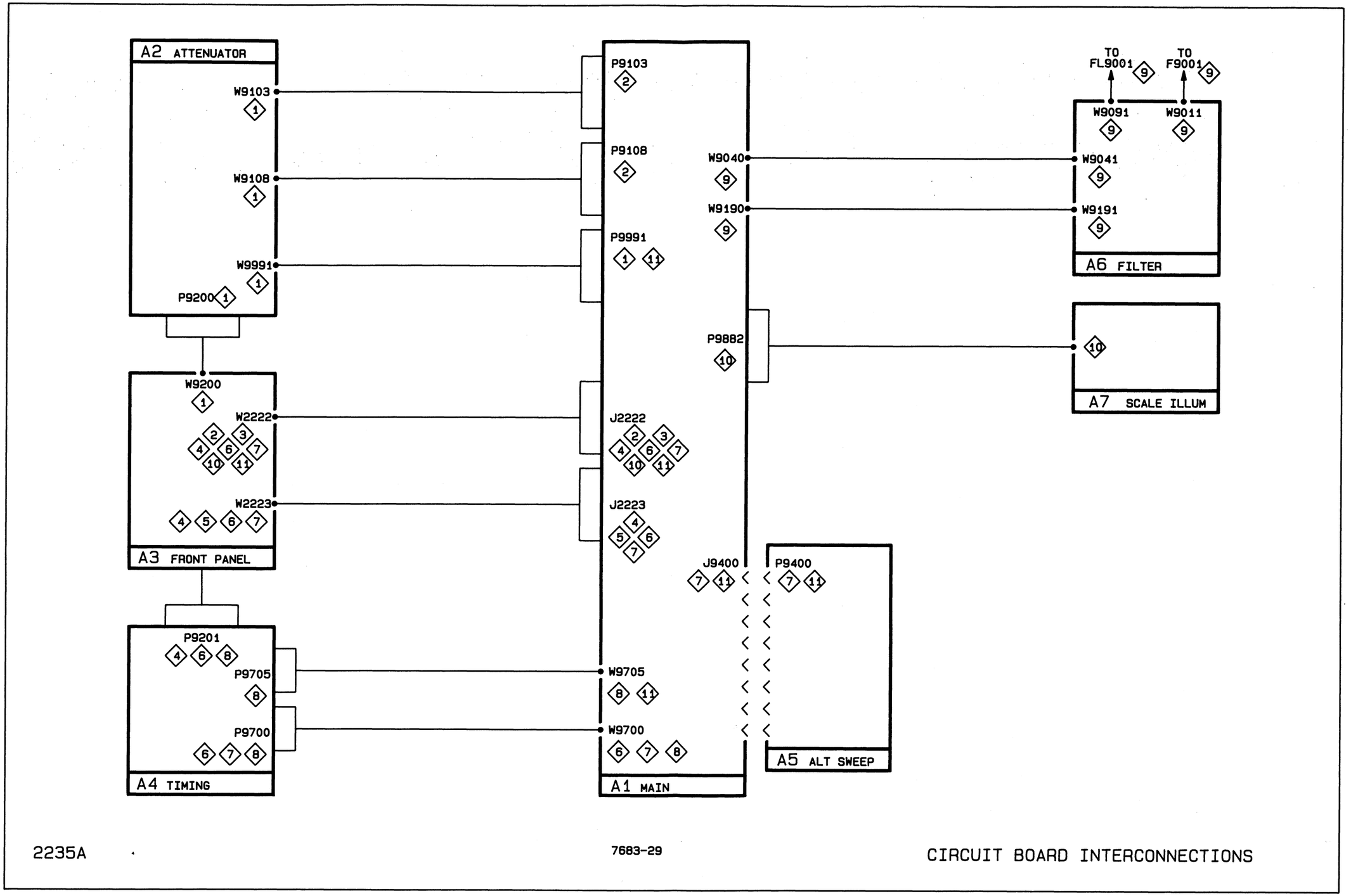
WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	HOLDOFF	6, 2A	6, 2A
2	NOT USED	6, 1D	6, 1C
3	XY1(L)	4, 1A	4, 1B
4	HORIZ_POS	8, 1B	8, 1B

P9882 (A1) to W9882 (A7)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	ILLUM_CONTROL	10, 5C	
2	ILLUM_VOLT	10, 5C	

J9400 (A1) to P9400 (A5)

WIRE NO.	LINE NAME	TO/FROM	
		DIAG. NO. AND GRID COORDINATES	DIAG. NO. AND GRID COORDINATES
1	B_TRIG_SIGNAL	7, 4D	
2	NOT USED	11, 3G	
3	B_SLOPE	7, 4D	
4	GND	11, 3G	
5	GND	11, 3G	
6	B_LEVEL	7, 4D	
7	A_DISP	7, 2H	
8	SEP(L)	7, 2H	
9	B_ONLY(L)	7, 2D	
10	B_INTENS	7, 3H	
11	Z_DRIVE	7, 3H	
12	HALT	7, 2D	
13	B_DISP	7, 2H	
14	CH1_SELECT	7, 2D	
15	A_ONLY(L)	7, 1D	
16	DELAY	7, 3D	
17	GND	11, 4G	
18	GND	11, 4G	
19	GND	11, 4G	
20	B_RETRACE	7, 4D	
21	GND	11, 4G	
22	VALT(L)	7, 2D	
23	A_SWP	7, 3D	
24	ALT_SYNC	7, 1D	
25	B_SWP	7, 3D	
26	GND	11, 4G	
27	GND	11, 4G	
28	-8.6V	11, 4G	
29	+5.2V	11, 3G	
30	+8.6V	11, 3G	



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CIRCUIT BOARD INTERCONNECTIONS

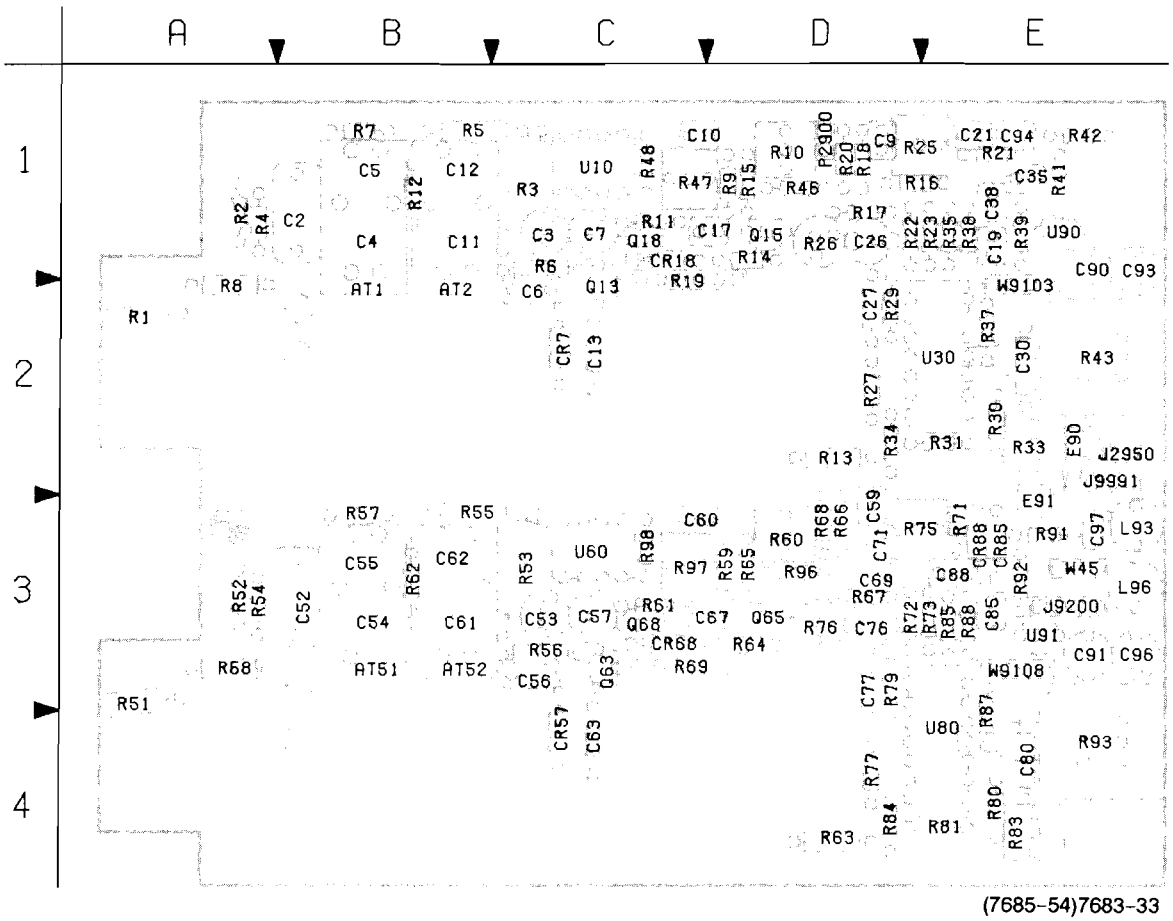

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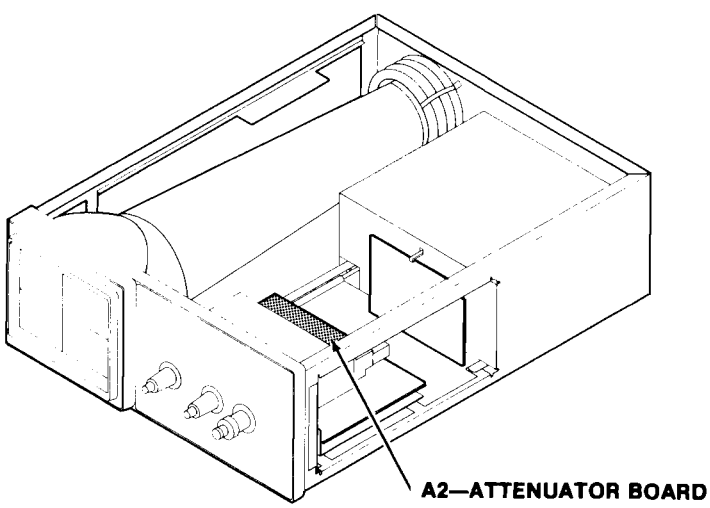
Figure 9-5. A2—Attenuator board.

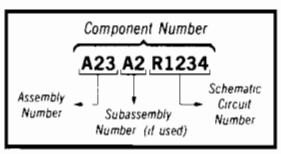


A2—ATTENUATOR BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
AT1	1	C90	1	R11	1	R63	1
AT2	1	C91	1	R12	1	R64	1
AT51	1	C93	1	R13	1	R65	1
AT52	1	C94	1	R14	1	R66	1
		C96	1	R15	1	R67	1
C2	1	C97	1	R16	1	R68	1
C3	1			R17	1	R69	1
C4	1	CR7	1	R18	1	R71	1
C5	1	CR18	1	R19	1	R72	1
C6	1	CR57	1	R20	1	R73	1
C7	1	CR68	1	R21	1	R75	1
C9	1	CR85	1	R22	1	R76	1
C10	1	CR88	1	R23	1	R77	1
C11	1			R25	1	R79	1
C12	1	E90	1	R26	1	R80	1
C13	1	E91	1	R27	1	R81	1
C17	1			R29	1	R83	1
C19	1	J2950	1	R30	1	R84	1
C21	1	J9200	1	R31	1	R85	1
C26	1	J9991	1	R33	1	R87	1
C27	1			R34	1	R88	1
C30	1	L93	1	R35	1	R91	1
C35	1	L96	1	R37	1	R92	1
C38	1			R38	1	R93	1
C52	1	P2900	1	R39	1	R96	1
C53	1			R41	1	R97	1
C54	1	Q13	1	R42	1	R98	1
C55	1	Q15	1	R43	1		
C56	1	Q18	1	R46	1	S1	1
C57	1	Q63	1	R47	1	S10	1
C59	1	Q65	1	R48	1	S51	1
C60	1	Q68	1	R51	1	S60	1
C61	1			R52	1		
C62	1	R1	1	R53	1	U10	1
C63	1	R2	1	R54	1	U30	1
C67	1	R3	1	R55	1	U60	1
C69	1	R4	1	R56	1	U80	1
C71	1	R5	1	R57	1	U90	1
C76	1	R6	1	R58	1	U91	1
C77	1	R7	1	R59	1		
C80	1	R8	1	R60	1	W9103	1
C85	1	R9	1	R61	1	W9108	1
C88	1	R10	1	R62	1		

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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

CH 1 AND CH 2 ATTENUATORS DIAGRAM 1

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
J9100	1A	6A	W101 W102	1A 1A	6F 6F	W9991 W9991	1A 4A	7F 7F			

Partial A1 also shown on diagrams 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

ASSEMBLY A2

AT1	2B	2B	C91	4B	3E	R9	2D	1D	R62	4C	3B
AT2	2C	2B	C93	5B	1E	R10	2C	1D	R63	4D	4D
AT51	4B	3B	C94	5B	1E	R11	2D	1C	R64	4D	3D
AT52	4C	3B	C96	5B	3E	R12	2C	1B	R65	4D	3D
			C97	5B	3E	R13	2D	2D	R66	4D	3D
C2	2B	1B				R14	2D	1D	R67	4D	3D
C3	2D	1C	CR7	2D	2C	R15	2D	1D	R68	4D	3D
C4	2B	1B	CR18	2D	1C	R16	2D	1D	R69	4E	3C
C5	2B	1B	CR57	4D	4C	R17	2D	1D	R71	4E	3E
C6	2C	2C	CR68	4D	3C	R18	2D	1D	R72	4F	3D
C7	2D	1C	CR85	5F	3E	R19	2E	2C	R73	4F	3E
C9	2D	1D	CR88	5F	3E	R20	2D	1D	R75	4F	3D
C10	2D	1C				R21	2E	1E	R76	4F	3D
C11	2C	1B	E90	4A	2E	R22	2E	1D	R77	4F	4D
C12	2C	1B	E91	4A	3E	R23	2E	1E	R79	4F	3D
C13	2D	2C				R25	2E	1D	R80	5F	4E
C17	2D	1C	J2950	1A	2E	R26	2F	1D	R81	5F	4E
C19	5C	1E	J2950	1A	2E	R27	2F	2D	R83	5E	4E
C21	2E	1E	J9200	3H	3E	R29	2F	2D	R84	5F	4D
C26	2F	1D	J9200	5E	3E	R30	3F	2E	R85	5F	3E
C27	2F	2D	J9200	5H	3E	R31	3F	2E	R87	5F	4E
C30	3F	2E	J9991	1A	2E	R33	3F	2E	R88	5F	3E
C35	3F	1E	J9991	4A	2E	R34	3F	2D	R91	5F	3E
C38	3G	1E				R35	3F	1E	R92	5F	3E
C52	4A	3B	L93	5A	3E	R37	3F	2E	R93	5E	4E
C53	4C	3C	L96	5A	3E	R38	3G	1E	R96	4D	3D
C54	4B	3B				R39	3G	1E	R97	5D	3C
C55	4B	3B	P2900	2H	1D	R41	3F	1E	R98	5D	3C
C56	4C	3C				R42	3G	1E			
C57	4D	3C	Q13	2D	2C	R43	3G	2E	S1	3A	2A
C59	4D	3D	Q15	2D	1D	R46	3D	1D	S10	3E	2B
C60	4D	3C	Q18	2D	1C	R47	3D	1C	S51	3A	4A
C61	4C	3B	Q63	4D	3C	R48	3D	1C	S60	4E	4B
C62	4C	3B	Q65	4D	3D	R51	4A	3A			
C63	4D	4C	Q68	4D	3C	R52	4A	3A	U10	2C	1C
C67	4D	3C				R53	4C	3C	U30	2G	2E
C69	5C	3D	R1	2A	2A	R54	4A	3A	U60	4C	3C
C71	4E	3D	R2	2A	1A	R55	4C	3B	U80	4G	4E
C76	4F	3D	R3	2C	1C	R56	4C	3C	U90	5C	1E
C77	4F	3D	R4	2A	1A	R57	4B	3B	U91	5C	3E
C80	5F	4E	R5	2C	1B	R58	4B	3A			
C85	5F	3E	R6	2C	1C	R59	4D	3D	W9103	2H	2E
C88	5G	3E	R7	2B	1B	R60	4C	3D	W9108	4H	3E
C90	4B	1E	R8	2B	2A	R61	4D	3C			

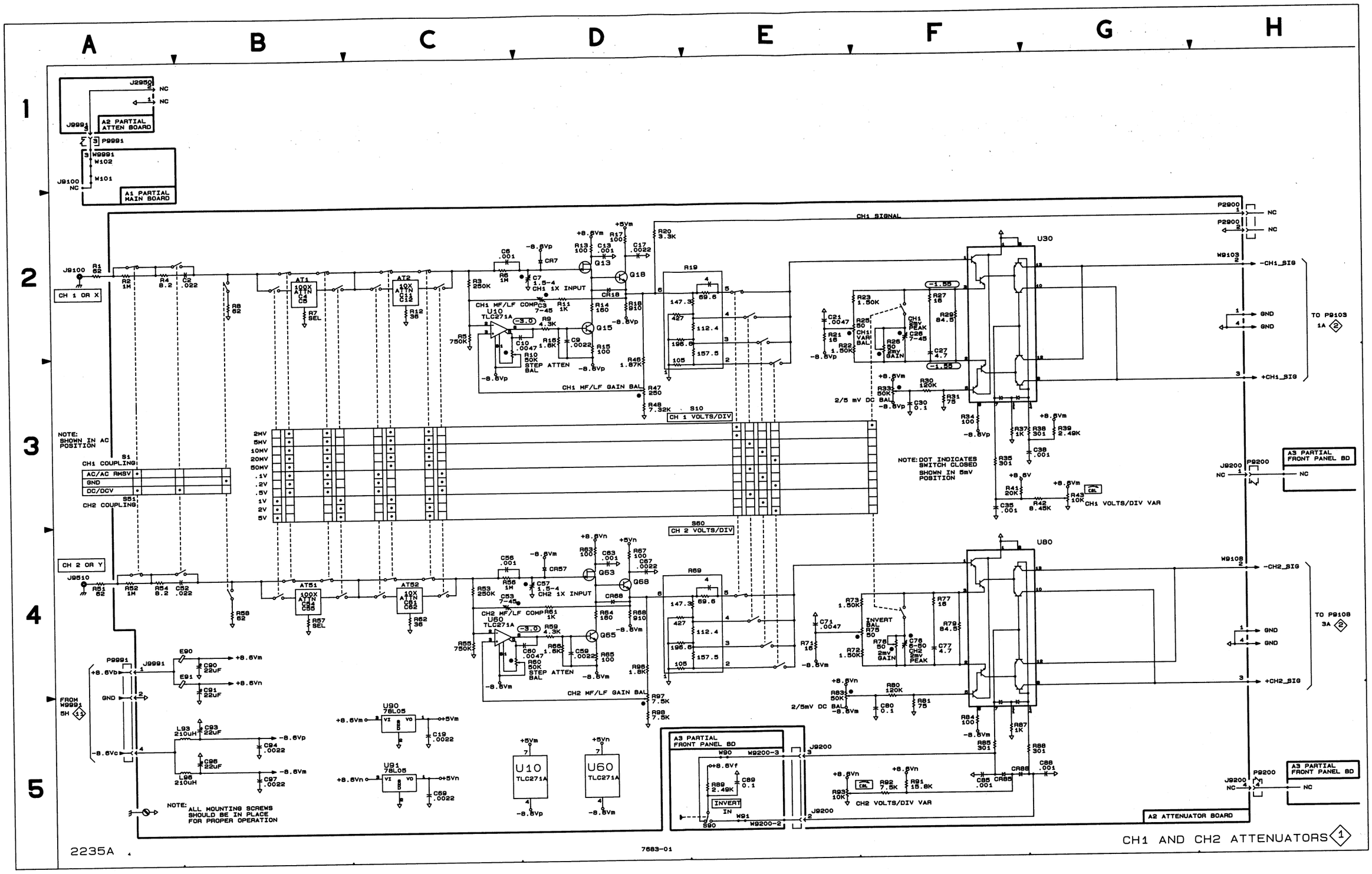
ASSEMBLY A3

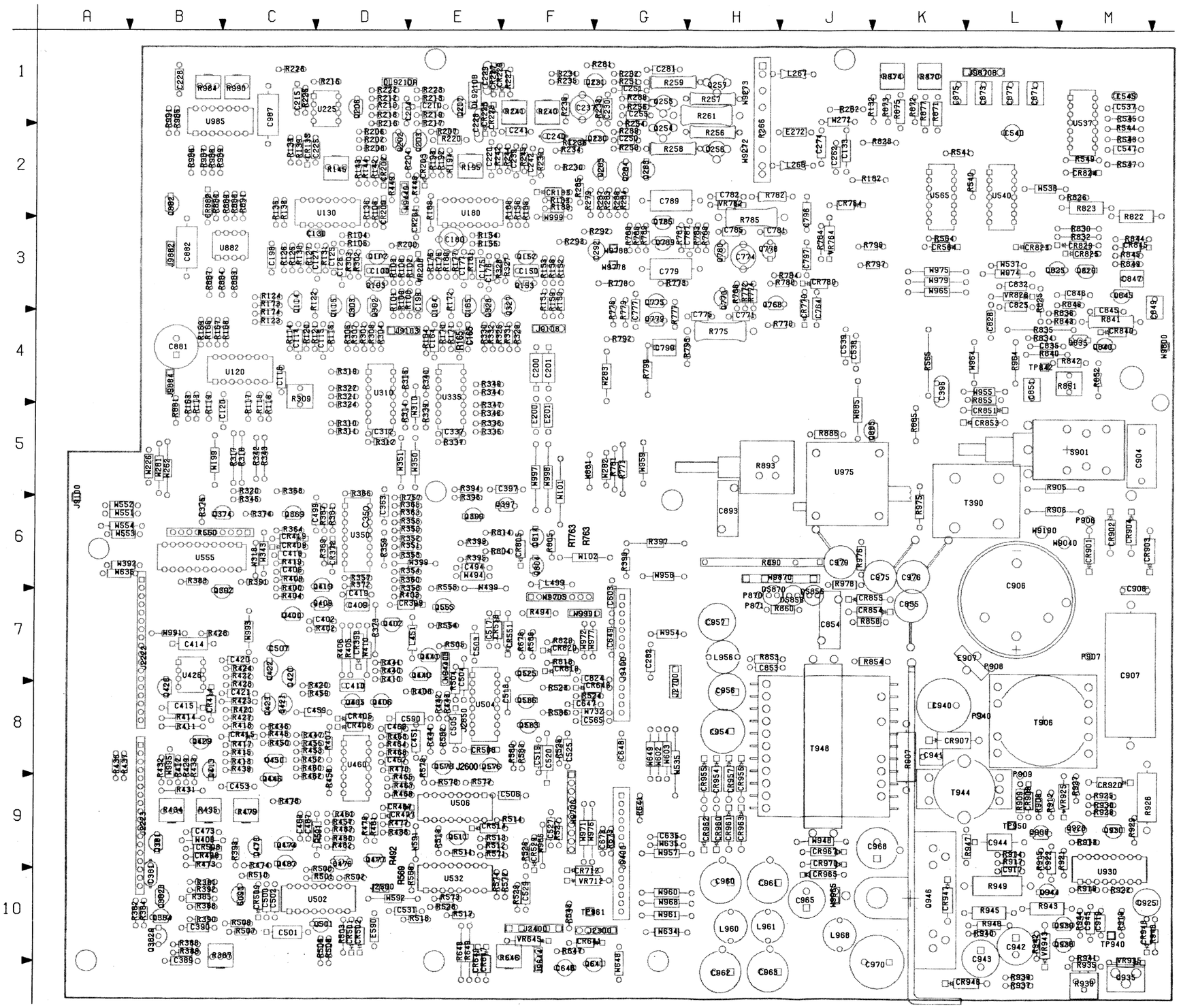
C89	5E	3B	R89	5E	3B	S90	5E	4B	W9200	5F	2C

Partial A3 also shown on diagrams 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

OTHER PARTS

J9100	2A	CHASSIS	J9510	4A	CHASSIS						



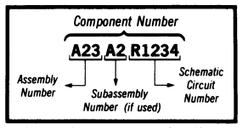


(7685-56)7683-34A

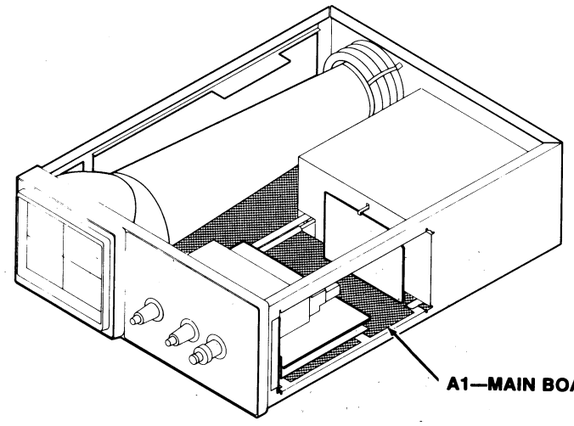
Figure 9-6. A1—Main board.

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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



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	C519	6	C970	10	CR970	10	Q382	4	R120	2
C114	2	C520	6	C975	10			Q384	4	R121	2
C115	2	C525	6	C976	10	DL9210	3	Q392	4	R122	2
C116	3	C527	6	C979	10			Q397	4	R123	2
C120	3	C529	6	C987	8	DS856	10	Q399	4	R124	2
C125	2	C531	6			DS858	10	Q400	5	R125	2
C126	2	C537	3	CR133	2	DS870	10	Q402	5	R126	2
C127	2	C538	2	CR183	2			Q405	5	R127	2
C130	2	C539	2	CR200	2	E200	11	Q406	5	R130	2
C133	2	C540	3	CR201	2	E201	11	Q409	4	R131	2
C150	2	C540	11	CR202	2	E272	11	Q413	5	R132	2
C164	2	C545	2	CR203	2	E590	11	Q419	4	R133	2
C165	2	C547	2	CR226	3	E907	9	Q420	5	R135	2
C175	2	C565	4	CR227	3			Q421	5	R136	2
C176	2	C590	5	CR228	3	J2222	2	Q422	5	R138	2
C177	2	C590	11	CR229	3	J2222	3	Q423	5	R139	2
C180	2	C603	7	CR372	4	J2222	4	Q428	5	R142	2
C198	2	C635	7	CR393	4	J2222	6	Q429	5	R143	2
C199	2	C646	7	CR399	4	J2223	4	Q440	2	R144	2
C200	11	C647	7	CR405	5	J2223	5	Q441	2	R145	2
C201	11	C648	7	CR406	5	J2223	6	Q446	5	R150	2
C204	3	C649	7	CR409	4	J2300	7	Q450	5	R151	2
C210	3	C673	7	CR414	5	J2400	11	Q473	5	R152	2
C215	3	C764	8	CR415	5	J2500	5	Q474	5	R153	2
C220	11	C771	8	CR419	4	J2600	6	Q476	5	R154	2
C225	3	C774	8	CR467	5	J2700	10	Q477	5	R155	2
C226	3	C775	8	CR476	5	J2850	6	Q487	5	R156	2
C228	3	C777	8	CR477	5	J9100	1	Q501	6	R158	2
C229	3	C779	8	CR501	6	J9103	2	Q509	6	R159	2
C237	3	C781	8	CR502	6	J9108	2	Q511	6	R163	2
C239	3	C782	8	CR503	6	J9400	7	Q525	6	R164	2
C240	3	C785	8	CR508	6	J9400	11	Q555	6	R165	2
C241	3	C787	8	CR509	6	J9644	7	Q576	6	R166	2
C242	3	C789	8	CR514	6	J9870	10	Q578	6	R167	2
C250	3	C796	11	CR518	6	J9882	10	Q583	10	R168	2
C251	3	C797	11	CR529	6	J9884	8	Q586	10	R169	2
C255	3	C799	11	CR551	10			Q641	7	R170	2
C262	3	C824	10	CR564	4	L266	3	Q768	8	R171	2
C274	11	C825	10	CR641	7	L267	3	Q770	8	R172	2
C281	3	C828	10	CR647	7	L451	11	Q775	8	R173	2
C282	3	C832	10	CR648	7	L499	11	Q778	8	R174	2
C292	3	C835	10	CR649	7	L956	10	Q779	8	R175	2
C312	4	C845	10	CR712	7	L960	10	Q780	8	R176	2
C337	4	C846	10	CR764	8	L961	10	Q785	8	R177	2
C350	4	C847	10	CR770	8	L968	10	Q789	8	R180	2
C363	4	C849	10	CR780	8			Q804	10	R181	2
C381	4	C851	10	CR805	10	P870	10	Q814	10	R182	2
C389	4	C853	10	CR818	10	P871	10	Q825	10	R183	2
C390	4	C854	10	CR820	10	P908	9	Q829	10	R185	2
C396	9	C855	10	CR823	10	P909	9	Q835	10	R186	2
C397	4	C871	10	CR824	10	P940	9	Q840	10	R188	2
C402	5	C873	10	CR825	10			Q845	10	R189	2
C406	4	C875	10	CR829	10	Q102	2	Q882	10	R192	2
C409	4	C877	10	CR840	10	Q103	2	Q885	10	R193	2
C410	5	C881	10	CR845	10	Q114	2	Q908	9	R194	2
C414	5	C882	10	CR851	10	Q115	2	Q928	9	R195	2
C415	5	C893	10	CR853	10	Q152	2	Q930	9	R200	2
C418	4	C904	9	CR854	10	Q153	2	Q935	9	R202	3
C419	4	C906	9	CR855	10	Q164	2	Q938	9	R203	3
C420	5	C907	9	CR882	10	Q165	2	Q939	9	R204	3
C421	5	C908	9	CR901	9	Q202	3	Q944	9	R206	3
C451	11	C917	9	CR902	9	Q203	3	Q946	9	R207	3
C453	5	C919	9	CR903	9	Q206	3	Q947	9	R210	3
C459	5	C922	9	CR904	9	Q207	3			R212	3
C460	5	C925	9	CR907	9	Q230	3	R100	2	R213	3
C467	5	C940	9	CR908	9	Q231	3	R101	2	R215	3
C469	5	C941	9	CR920	9	Q254	3	R102	2	R216	3
C473	5	C942	9	CR946	9	Q255	3	R103	2	R217	3
C487	5	C943	9	CR947	9	Q256	3	R104	2	R218	3
C494	11	C944	9	CR948	9	Q257	3	R105	2	R219	3
C499	11	C945	9	CR954	10	Q283	3	R106	2	R220	11
C500	6	C954	10	CR955	10	Q284	3	R108	2	R222	3
C501	6	C956	10	CR956	10	Q285	3	R109	2	R223	3
C502	6	C957	10	CR957	10	Q302	4	R113	2	R225	3
C503	6	C960	10	CR960	10	Q303	4	R114	2	R226	3
C504	6	C961	10	CR961	10	Q327	4	R115	2	R227	3
C505	6	C962	10	CR962	10	Q328	4	R116	2	R230	3
C506	6	C963	10	CR963	10	Q369	4	R117	2	R231	3
C507	11	C965	10	CR965	10	Q374	4	R118	2	R233	3
C517	6	C968	10	CR967	10	Q381	4	R119	2	R234	3
C518	6										

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
R235	3	R361	4	R457	5	R646	7	R888	10	U504	6
R236	3	R363	4	R458	5	R647	7	R889	10	U506	6
R239	3	R364	4	R459	5	R648	7	R890	10	U532	6
R240	3	R365	4	R460	5	R649	7	R891	10	U537	2
R241	3	R366	4	R461	5	R673	7	R893	10	U540	2
R242	3	R367	4	R462	5	R676	8	R905	9	U555	4
R244	3	R368	4	R463	5	R757	4	R906	9	U565	4
R245	3	R369	4	R464	5	R763	4	R907	9	U882	10
R250	3	R372	4	R465	5	R764	8	R908	9	U930	9
R251	3	R373	4	R467	5	R766	8	R909	9	U975	10
R254	3	R374	4	R468	5	R768	8	R912	9	U985	8
R255	3	R375	4	R469	5	R770	8	R913	9		
R256	3	R381	4	R470	5	R771	8	R914	9	VR200	2
R257	3	R382	4	R473	5	R772	8	R915	9	VR645	7
R258	3	R383	4	R474	5	R773	8	R916	9	VR712	7
R259	3	R384	4	R476	5	R774	8	R917	9	VR764	8
R261	3	R385	4	R477	5	R775	8	R919	9	VR782	8
R262	3	R386	4	R478	5	R776	8	R921	9	VR828	10
R266	3	R387	4	R479	5	R777	8	R922	9	VR925	9
R279	3	R388	4	R480	5	R778	8	R925	9	VR935	9
R281	3	R389	4	R481	5	R779	8	R926	9	VR943	9
R282	3	R390	4	R482	5	R780	8	R927	9		
R283	3	R391	4	R486	5	R781	8	R928	9	W101	1
R284	3	R392	4	R487	5	R782	8	R929	9	W102	1
R285	3	R393	4	R492	5	R783	8	R930	9	W199	2
R286	3	R394	4	R494	11	R784	8	R935	9	W226	3
R287	3	R395	4	R500	6	R785	8	R937	9	W262	3
R288	3	R396	4	R501	6	R786	8	R938	9	W272	11
R289	3	R397	9	R502	6	R787	8	R939	9	W281	3
R292	3	R398	9	R503	6	R788	8	R940	9	W282	3
R293	3	R399	4	R504	6	R789	8	R941	9	W283	3
R301	4	R400	5	R505	6	R792	8	R942	9	W310	4
R302	4	R402	5	R506	6	R793	8	R943	9	W318	4
R303	4	R403	5	R507	6	R796	11	R944	9	W343	4
R304	4	R404	5	R508	6	R797	11	R945	9	W350	4
R305	4	R405	5	R509	6	R799	11	R946	9	W351	4
R306	4	R406	5	R510	6	R804	10	R947	9	W392	4
R307	4	R407	5	R511	6	R805	10	R948	9	W399	4
R309	4	R408	5	R512	6	R814	10	R949	9	W408	11
R310	4	R409	4	R513	6	R818	10	R964	11	W410	5
R311	4	R410	5	R514	6	R820	10	R975	10	W494	11
R312	4	R411	5	R516	6	R822	10	R976	10	W499	11
R314	4	R412	5	R517	6	R823	10	R978	10	W535	2
R315	4	R413	5	R518	6	R825	10	R984	8	W537	2
R317	4	R414	5	R523	6	R826	10	R985	8	W538	2
R318	4	R415	5	R524	6	R828	10	R986	8	W551	4
R319	4	R416	5	R525	6	R830	10	R987	8	W552	4
R320	4	R417	5	R526	6	R832	10	R988	8	W553	4
R321	4	R419	4	R527	6	R834	10	R989	8	W554	4
R322	4	R420	5	R528	6	R835	10	R990	8	W591	11
R324	4	R421	5	R529	6	R836	10	R991	8	W592	11
R326	4	R422	5	R540	2	R840	10			W602	7
R327	4	R423	5	R541	2	R841	10	RT236	3	W603	7
R328	4	R424	5	R544	2	R842	10	RT763	4	W634	7
R329	4	R426	5	R545	2	R843	10			W635	7
R330	4	R427	5	R547	2	R844	10	S901	9	W636	4
R331	4	R428	5	R548	2	R845	10			W648	7
R332	4	R429	5	R549	2	R846	10	T390	9	W649	7
R335	4	R431	5	R550	4	R849	10	T906	9	W732	8
R336	4	R432	5	R554	6	R851	10	T944	9	W881	10
R337	4	R433	5	R555	6	R852	10	T948	10	W885	10
R339	4	R434	5	R564	4	R853	10			W948	10
R340	4	R435	5	R565	4	R854	10	TP397	4	W954	11
R342	4	R436	5	R566	8	R855	10	TP460	5	W955	11
R343	4	R437	5	R568	6	R858	10	TP504	6	W956	11
R344	4	R439	5	R569	6	R860	10	TP842	10	W957	11
R345	4	R440	2	R571	6	R870	10	TP940	9	W959	11
R346	4	R441	2	R572	6	R871	10	TP950	9	W960	11
R347	4	R442	2	R573	6	R872	10	TP961	11	W961	11
R349	4	R443	2	R574	6	R873	10			W964	11
R350	4	R444	2	R576	6	R874	10	U120	2	W965	11
R351	4	R445	5	R577	6	R875	10	U130	2	W966	11
R352	4	R446	5	R578	6	R877	10	U180	2	W968	11
R353	4	R447	5	R580	6	R880	10	U225	3	W971	11
R354	4	R448	2	R582	6	R881	10	U310	4	W972	11
R356	4	R449	2	R583	10	R883	10	U335	4	W974	11
R357	4	R450	5	R586	10	R884	10	U350	4	W975	11
R358	4	R452	5	R591	5	R885	10	U426	5	W976	11
R359	4	R453	5	R641	7	R886	10	U460	5	W977	11
R360	4	R455	5	R645	7	R887	10	U502	6	W979	11

A1—MAIN BOARD (cont)

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
W991	11	W9700	7
W993	11	W9700	8
W995	11	W9705	8
W997	11	W9705	11
W998	11	W9778	8
W999	11	W9788	8
W9040	9	W9800	10
W9190	9	W9870	10
W9272	3	W9965	10
W9273	3	W9991	1
W9440	2	W9991	11
W9700	6		

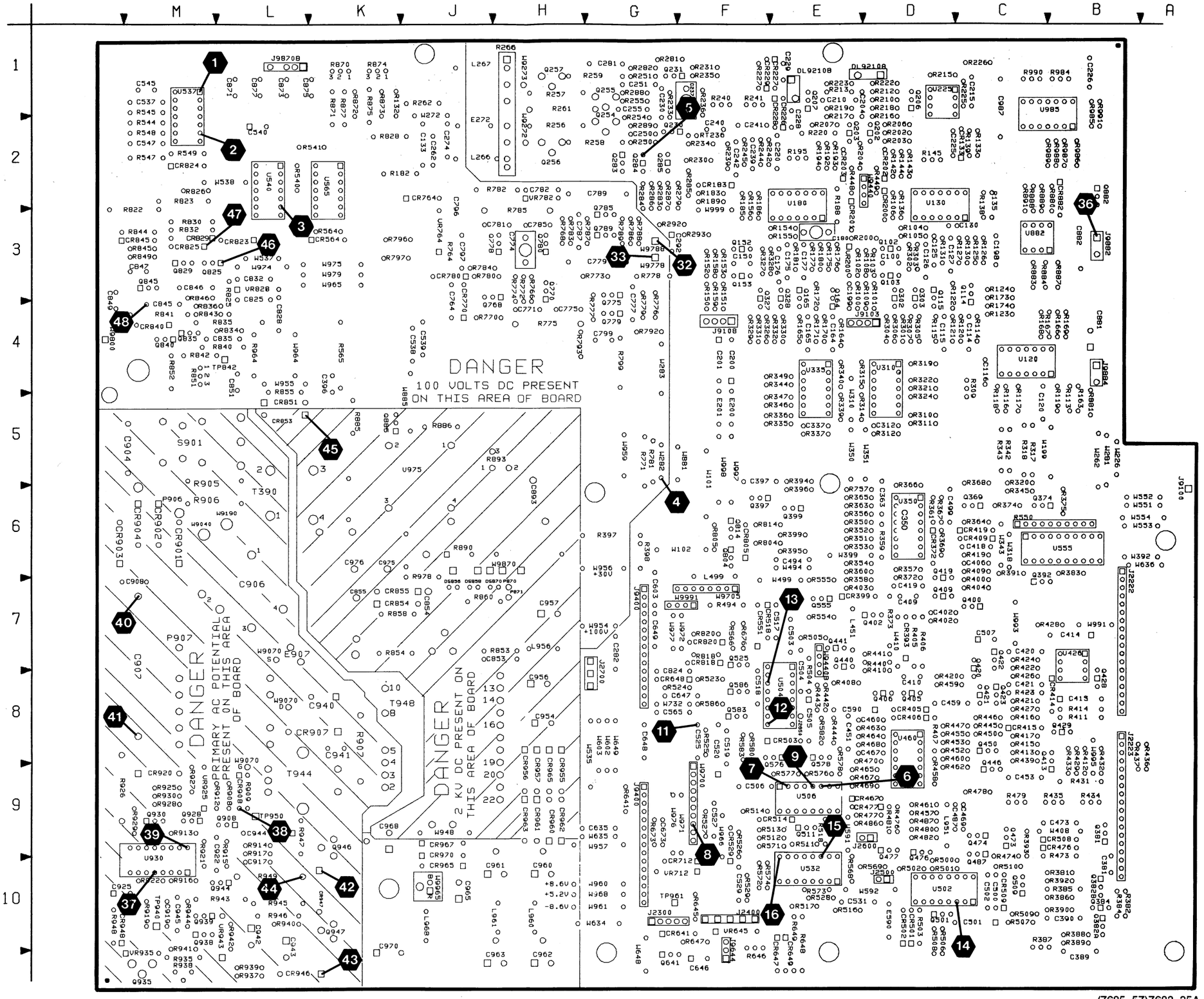


Figure 9-7. Circuit View of A1—Main board.

(7685-57)7683-35A

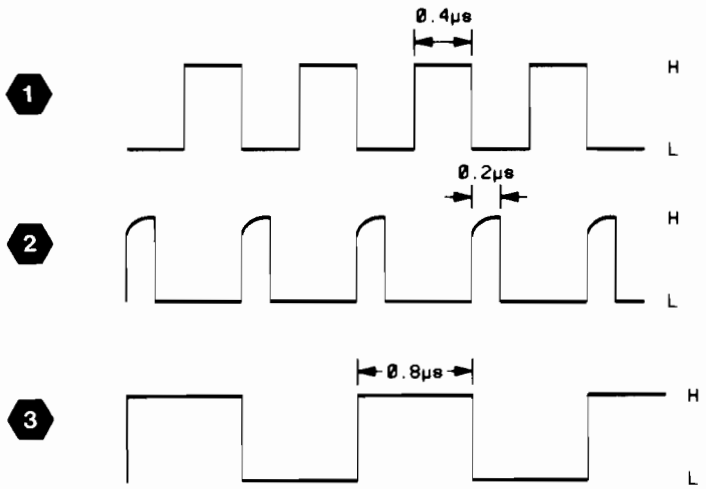
2235A CONTROL SETTINGS

DC Voltages

AC-GND-DC (both)	GND
VOLTS/DIV (both)	0.1V

AC Waveforms

Vertical MODE	BOTH, CHOP
A TRIGGER Mode	P-P AUTO



(4206-93)7683-36

VERTICAL PREAMPLIFIERS AND SWITCHING DIAGRAM 2

ASSEMBLY A1

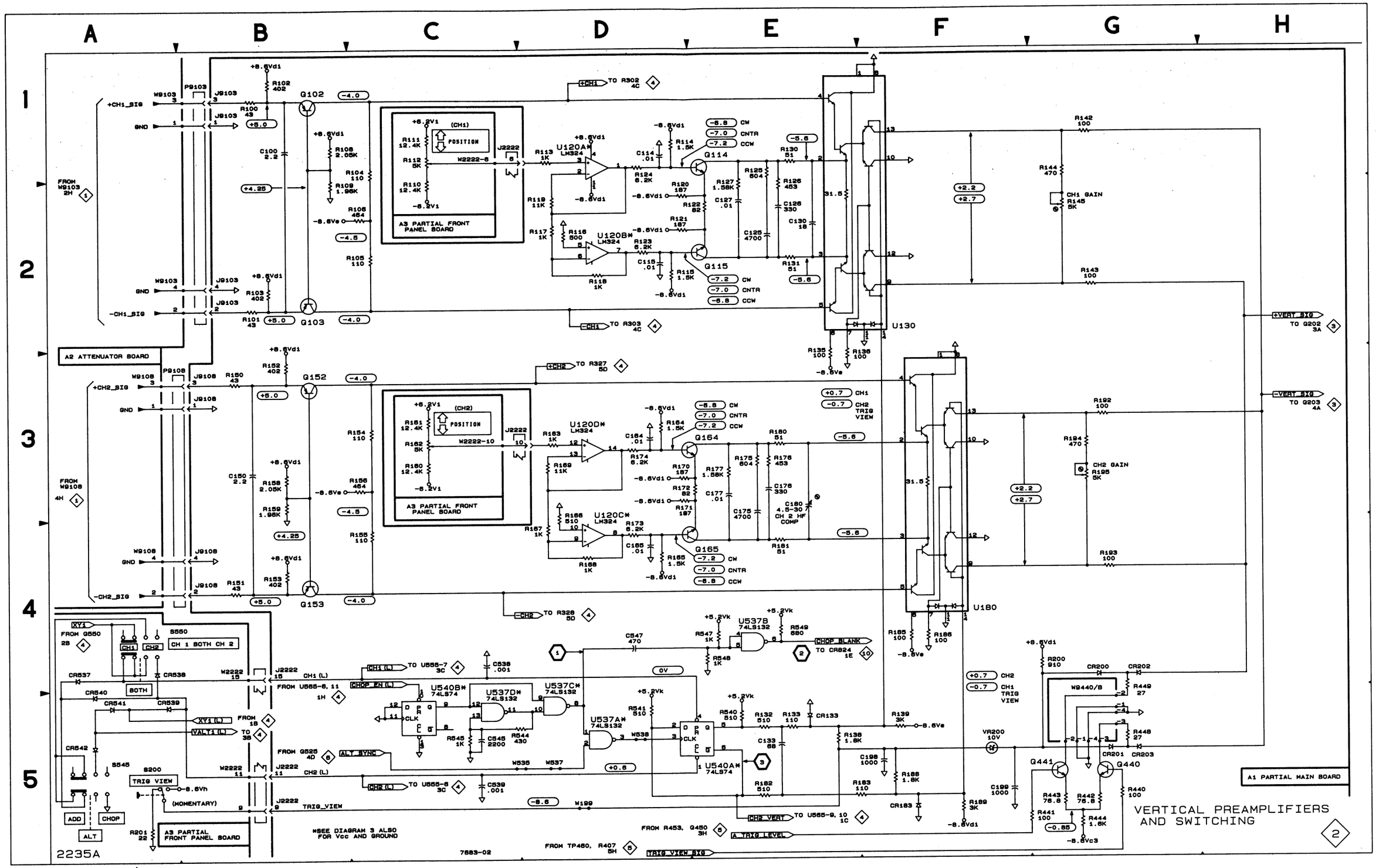
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C100	1B	3D	Q153	4B	3F	R143	2G	2D	R195	3G	2E
C114	1D	4C	Q164	3D	4E	R144	1G	2D	R200	4G	3D
C115	2D	4D	Q165	4D	4E	R145	2G	2D	R440	5G	7D
C125	2E	3D	Q440	5G	7E	R150	3B	4F	R441	5F	7D
C126	2E	3D	Q441	5G	7E	R151	4B	4F	R442	5G	8E
C127	2E	3D				R152	3B	3F	R443	5G	8E
C130	2E	3C	R100	1B	3E	R153	4B	3F	R444	5G	8E
C133	5E	2J	R101	2B	4D	R154	3C	3E	R448	5G	2E
C150	3B	3F	R102	1B	3E	R155	4C	3E	R449	4G	2D
C164	3D	4E	R103	2B	3D	R156	3C	3F	R540	5E	2L
C165	4D	4E	R104	1C	3D	R158	3B	3F	R541	5D	2K
C175	3E	3E	R105	2C	3D	R159	3B	4F	R544	5C	2M
C176	3E	3E	R106	2C	3D	R163	3D	5B	R545	5C	1M
C177	3E	3E	R108	1B	3D	R164	3D	4E	R547	4E	2M
C180	3E	3E	R109	2B	3D	R165	4D	4E	R548	4E	2M
C198	5E	3C	R113	1D	5B	R166	3D	4B	R549	4E	2M
C199	5F	4E	R114	1D	4C	R167	4D	4B			
C538	4C	4J	R115	2D	4D	R168	4D	4C	U120A	1D	4C
C539	5C	4J	R116	2D	5C	R169	3D	4B	U120B	2D	4C
C545	5C	1M	R117	2D	5C	R170	3D	4E	U120C	4D	4C
C547	4D	2M	R118	2D	5C	R171	3D	4E	U120D	3D	4C
			R119	2D	5B	R172	3E	3E	U130	2E	2D
CR133	5E	2C	R120	2D	4C	R173	4D	3C	U180	4F	2E
CR183	5F	2F	R121	2D	4D	R174	3D	4C	U537A	5D	2M
CR200	4G	3D	R122	2E	4D	R175	3E	3E	U537B	4E	2M
CR201	5G	3E	R123	2D	4C	R176	3E	3E	U537C	5D	2M
CR202	4G	2D	R124	1D	3C	R177	3E	3E	U537D	5C	2M
CR203	5G	2E	R125	1E	3C	R180	3E	3E	U540A	5E	2L
			R126	1E	3C	R181	4E	3E	U540B	5C	2L
J2222	3D	7B	R127	1E	3C	R182	5E	2J			
J2222	4B	7B	R130	1E	3C	R183	5E	2F	VR200	5F	3E
J9103	1B	4D	R131	2E	3D	R185	4F	3F			
J9108	3B	4F	R132	5E	1K	R186	4F	3F	W199	5D	5B
			R133	5E	2C	R188	5F	3E	W535	5C	8G
Q102	1B	3D	R135	3E	3C	R189	5F	2F	W537	5D	3L
Q103	2B	3D	R136	3E	3D	R192	3G	2E	W538	5D	2L
Q114	1E	4C	R138	5E	3C	R193	4G	2E	W9440	4G	2E
Q115	2E	4D	R139	5F	2C	R194	3G	2E	W9440B	4G	2E
Q152	3B	3F	R142	1G	2D						

Partial A1 also shown on diagrams 1, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

ASSEMBLY A3

CR537	4A	3C	CR542	5A	4C	R160	3C	5D	S200	5A	3C
CR538	4A	3D				R161	3C	4D	S545	5A	4C
CR539	5A	3D	R110	1C	3D	R162	3C	4C	S550	4A	2C
CR540	4A	3C	R111	1C	3D	R201	5A	3C			
CR541	5A	5C	R112	1C	2C				W2222	1D	4A

Partial A3 also shown on diagrams 1, 3, 4, 5, 6, 7, 8, 9, 10, and 11.



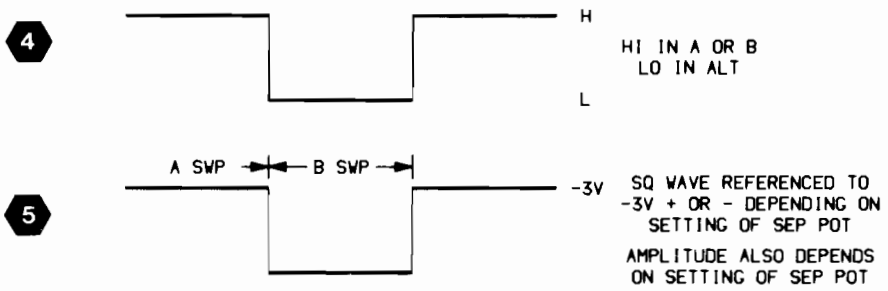
2235A CONTROL SETTINGS

DC Voltages

AC-GND-DC (both)	GND
VOLTS/DIV (both)	0.1V

AC Waveforms

Vertical MODE	BOTH, CHOP
A TRIGGER Mode	P-P AUTO



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VERTICAL OUTPUT AMPLIFIER DIAGRAM 3

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
C116	5E	4C	DL9210	3C	1E	R215	3B	1D	R259	2G	1G
C120	4E	5C				R216	3B	2D	R261	3G	1H
C204	3B	1E	J2222	2D	7B	R217	4B	2E	R262	3G	1J
C210	4B	1E				R218	3B	1D	R266	2H	2H
C215	3B	1C	L266	3G	2J	R219	4B	1E	R279	2F	2F
C225	4B	2D	L267	4G	1J	R222	3C	1D	R281	2E	1F
C226	3D	1B				R223	3C	1E	R282	2E	1G
C228	4D	2E	Q202	3B	2D	R225	4B	1C	R283	2E	2G
C229	3D	1E	Q203	4B	2E	R226	3D	1C	R284	2F	2G
C237	3F	1F	Q206	3B	1D	R227	3E	1F	R285	2G	2F
C239	3E	2F	Q207	4B	1E	R230	4F	2F	R288	1F	2G
C240	3E	2F	Q230	4F	2F	R231	3F	1F	R287	1F	2G
C241	3E	2F	Q231	3F	1F	R233	3F	1G	R288	2F	1G
C242	3E	2F	Q254	4G	2G	R234	4F	2F	R289	2F	2G
C250	4F	2G	Q255	3G	1G	R235	3F	1F	R292	1F	3F
C251	3F	1G	Q256	4G	2H	R236	3F	1F	R293	1F	3F
C255	2F	1G	Q257	2G	1H	R239	4E	2F			
C262	3G	2J	Q283	2F	2G	R240	3E	1F	RT236	3F	2F
C281	2E	1G	Q284	2F	2G	R241	3E	1F			
C282	2E	7G	Q285	2F	2G	R242	3E	2E	U225	4B	1D
C292	1F	3G				R244	3E	2F			
C537	4D	1M	R202	3B	2D	R245	3E	2F	W226	3D	5B
C540	4D	2L	R203	3B	2D	R250	4F	2G	W262	3G	5B
			R204	3B	2E	R251	3F	1G	W281	2E	5B
CR226	3D	2E	R206	3B	2D	R254	4F	2G	W282	2E	5G
CR227	3D	1E	R207	4B	2E	R255	3F	1G	W283	2E	4G
CR228	3D	2E	R210	3B	1D	R256	4G	2H	W9272	4H	2H
CR229	3D	1F	R212	3B	1D	R257	2G	1H	W9273	2H	1H
			R213	3B	1E	R258	4G	2G			

Partial A1 also shown on diagrams 1, 2, 4, 5, 6, 7, 8, 9, 10, and 11.

ASSEMBLY A3

R224	2C	4C	R280	2C	3C	S226	2C	4C			

Partial A3 also shown on diagrams 1, 2, 4, 5, 6, 7, 8, 9, 10, and 11.

A1 PARTIAL MAIN BOARD

A3 PARTIAL FRONT PANEL BOARD

FROM J8400-9 2H

TO CR419 3C

TO P9273 + UPPER CRT VERTICAL DEFLECTION PLATE 3H

TO P9272 - LOWER CRT VERTICAL DEFLECTION PLATE 3H

FROM 2H +VERT SIG

FROM 3H -VERT SIG

FROM J2222-6 3B

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

* SEE DIAGRAM 2 ALSO FOR OTHER PIN CONNECTIONS

2235A

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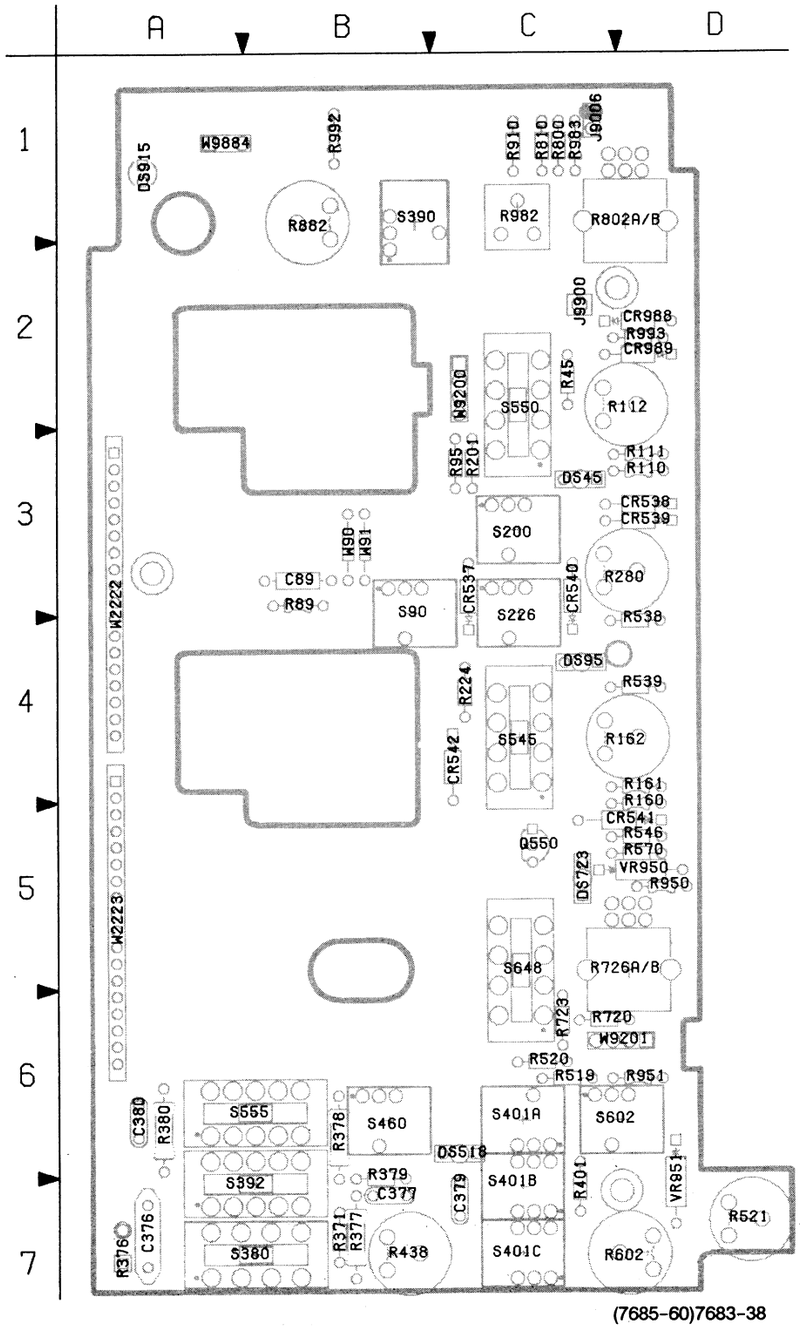
VERTICAL OUTPUT AMPLIFIER

3



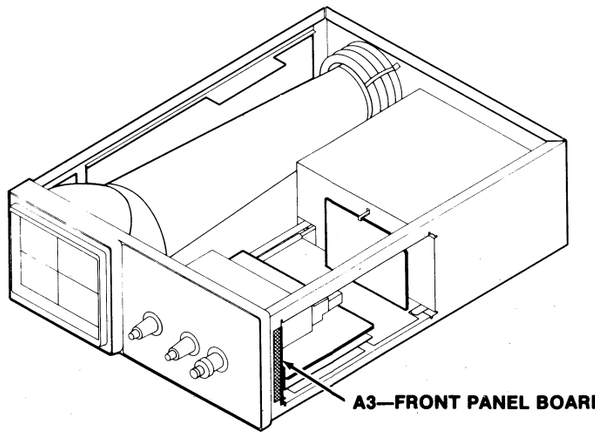
(7685-60)7683-38

Figure 9-8. A3—Front Panel board.

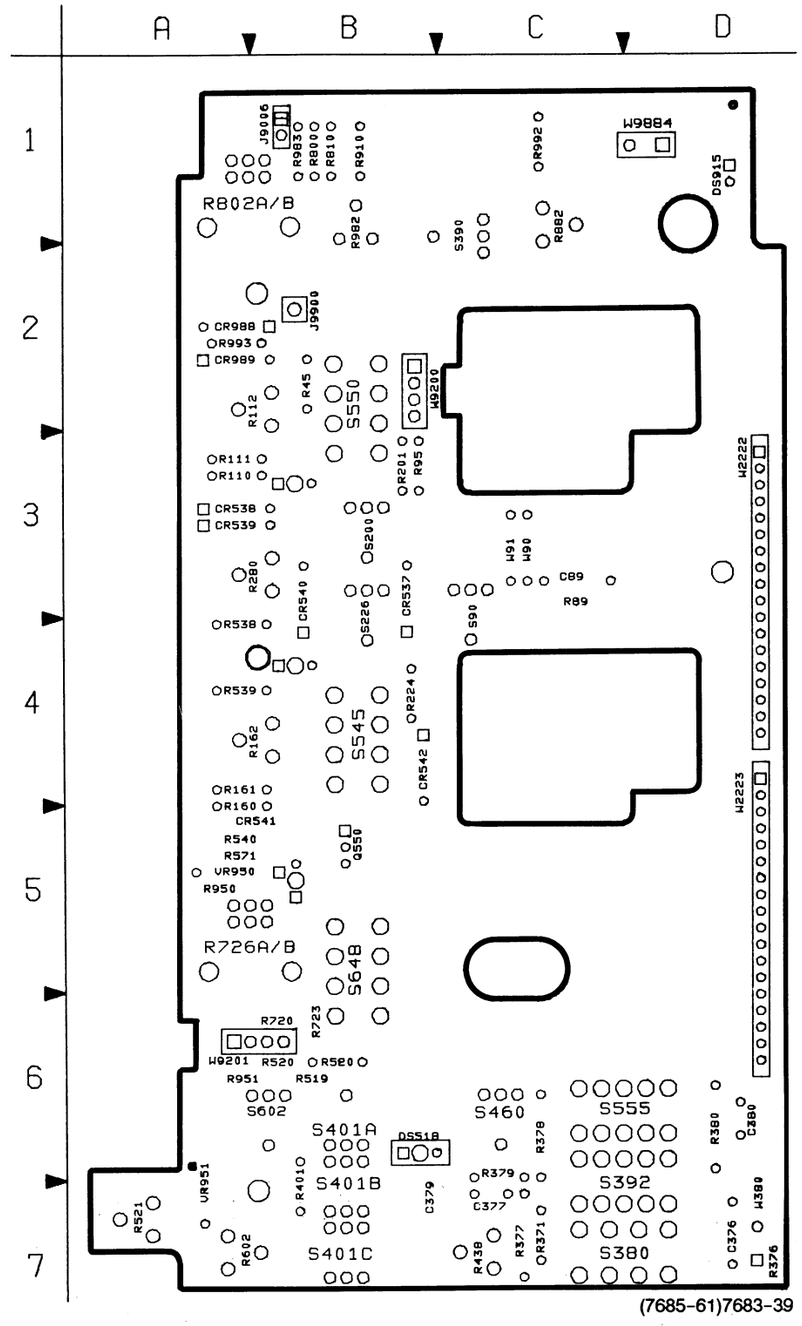
Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

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



A3—FRONT PANEL BOARD



(7685-61)7683-39

Figure 9-9. Circuit view of A3—Front Panel board.

A3—FRONT PANEL BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C89	1			R538	4	S226	3
C376	4	R89	1	R539	4	S380	4
C377	4	R110	2	R546	4	S390	10
C379	4	R111	2	R570	4	S392	4
C380	4	R112	2	R602	7	S401	6
		R160	2	R720	8	S460	5
CR537	2	R161	2	R723	6	S545	2
CR538	2	R162	2	R726	8	S550	2
CR539	2	R201	2	R800	10	S555	4
CR540	2	R224	3	R802	10	S602	7
CR541	2	R280	3	R810	10	S648	7
CR542	2	R371	4	R882	10		
CR988	8	R376	4	R910	9	VR950	11
CR989	8	R377	4	R950	11	VR951	11
		R378	4	R951	11		
DS518	6	R379	4	R982	10	W90	10
DS915	9	R380	4	R983	10	W91	10
		R401	6	R992	8	W2222	2
J9006	10	R438	5	R993	8	W2223	4
J9900	8	R519	6			W9200	1
		R520	6	S90	1	W9201	4
Q550	4	R521	6	S200	2	W9884	8

TRIGGER SELECT DIAGRAM 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
C312	4C	5D	R302	4C	3D	R345	2E	6C	R419	3G	6C
C337	5D	5E	R303	4C	3D	R346	5E	5E	R550	1C	6B
C363	4G	6D	R304	4C	4D	R347	5E	5E	R564	1E	3K
C397	2F	5E	R305	4C	4D	R349	5D	4E	R565	1E	4K
C406	3F	6C	R306	4C	4D	R350	4F	6D	R757	5H	6D
C409	3G	7D	R307	4D	4D	R351	5F	6D	R763	5G	6D
C418	3G	6C	R309	4C	4C	R352	5F	6D			
C419	3G	7D	R310	4C	5D	R353	5F	6D	RT763	5G	6D
C565	1E	8F	R311	4C	5D	R354	5F	6D			
			R312	4D	5D	R356	4F	6D	TP397	2F	6F
CR372	2G	6D	R314	4D	5E	R357	5F	6D			
CR393	2H	7D	R315	4D	4E	R358	5F	7D	U310	3D	4D
CR399	2H	7D	R317	2D	5C	R359	5G	6D	U335	4E	4E
CR409	3F	6C	R318	2D	5C	R360	5G	6D	U350A	4G	6D
CR419	3F	6C	R319	4D	4D	R361	5F	6D	U350B	5G	6D
CR564	1E	3K	R320	2D	5C	R363	4G	6D	U350C	5G	6D
			R321	4D	4D	R364	2G	6C	U350D	5F	6D
J2222	3C	7B	R322	4D	4D	R365	5G	6D	U350E	4F	6D
J2223	2C	9B	R324	4C	5D	R366	5G	6D	U555	2D	6B
J2223	3C	9B	R326	5D	4F	R367	5G	6D	U565B	1C	2K
			R327	5D	3F	R368	1G	5C	U565C	1D	2K
Q302	4C	4D	R328	5D	3F	R369	2G	6D			
Q303	4C	4D	R329	5D	4F	R372	2H	6D	W310	4F	5E
Q327	5D	4F	R330	5D	4E	R373	2H	7D	W318	2D	6C
Q328	5D	4E	R331	4D	4F	R374	3F	6C	W343	2D	6C
Q369	2G	6C	R332	5D	4E	R375	3F	6B	W350	4F	5E
Q374	3F	6B	R335	5D	5E	R383	2F	6B	W351	5F	5D
Q381	4F	9B	R336	5D	5E	R391	2F	6C	W392	2F	6A
Q392	2F	7B	R337	5E	5E	R393	2G	9C	W399	2G	6E
Q397	2F	6E	R339	5E	5E	R394	2G	5E	W551	2C	6A
Q399	2G	6E	R340	4E	4E	R395	2F	6E	W552	2C	6A
Q409	3G	7D	R342	2E	5C	R396	2G	6E	W553	2C	6A
Q419	3G	7D	R343	2E	5C	R399	2G	6E	W554	2C	6A
			R344	5E	4E	R409	3G	6C	W636	2D	6A
R301	4C	4D									

Partial A1 also shown on diagrams 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11.

ASSEMBLY A3

C376	3A	7A	R371	4B	7B	R538	1B	4D	S392	2B	7A
C377	4A	7B	R376	3A	7A	R539	1B	4D	S555	2B	6A
C379	4B	7C	R377	4A	7B	R546	1B	5D			
C380	3B	6A	R378	4A	6B	R570	1B	5D	W2223	2B	5A
			R379	4B	7B				W9201	1A	6C
Q550	1B	5C	R380	3B	6A	S380	3B	7A			

Partial A3 also shown on diagrams 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11.

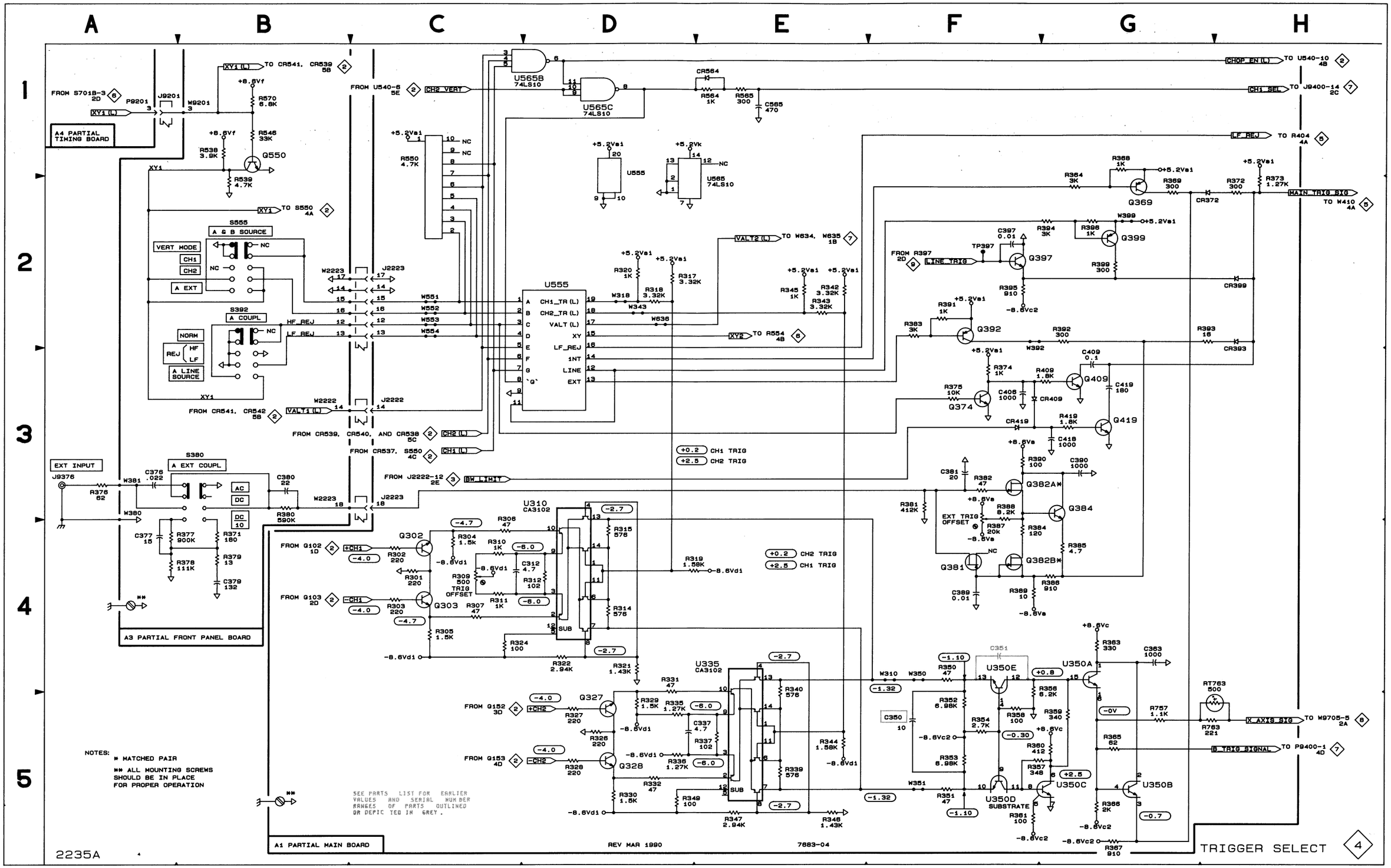
ASSEMBLY A4

P9201	1A	1A									

Partial A4 also shown on diagrams 6, 7, and 8.

OTHER PARTS

J9376	3A	CHASSIS									



TRIGGER P-P AUTO AND OUTPUT DIAGRAM 5

ASSEMBLY A1

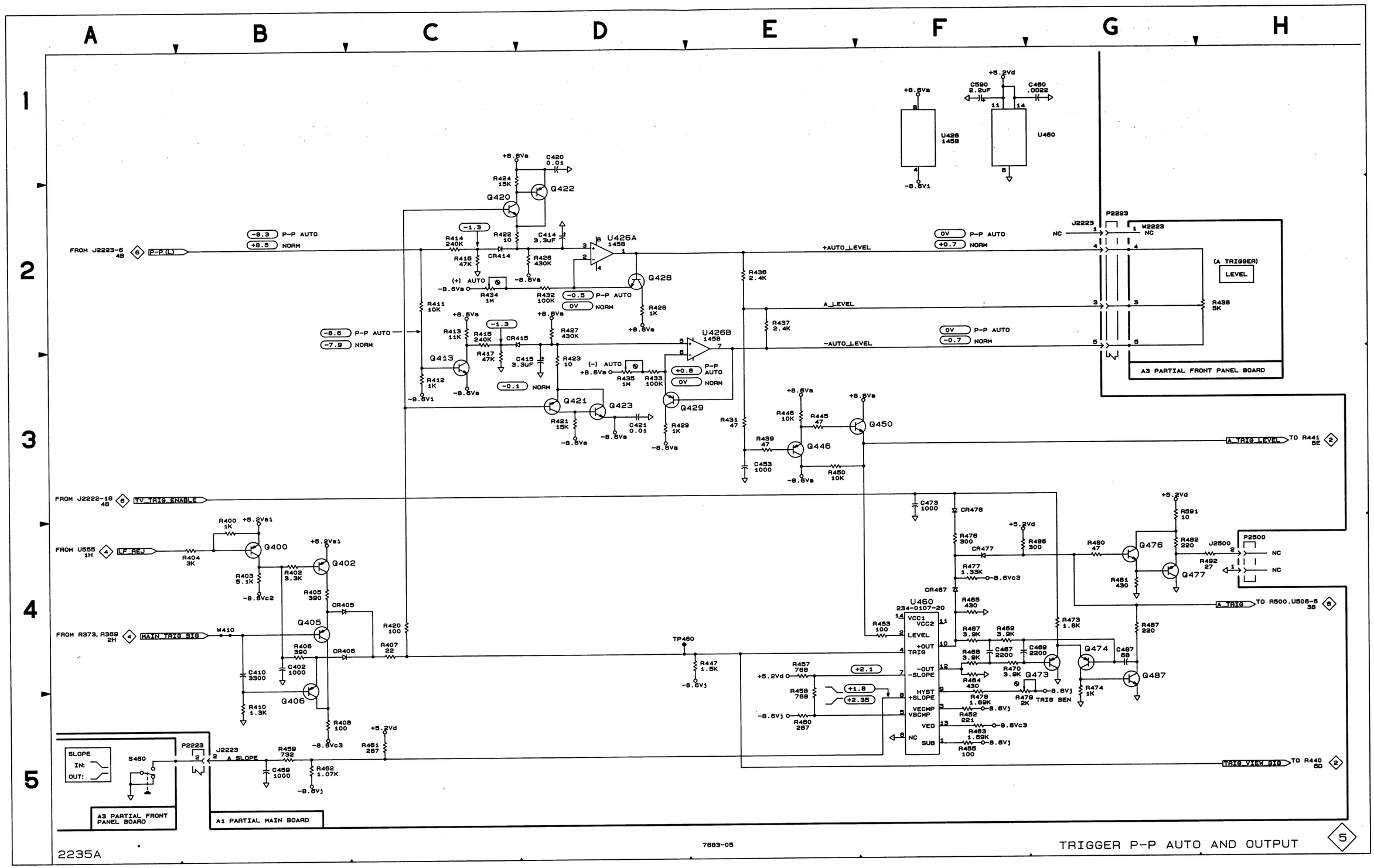
CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C402	4B	7D	Q420	2C	8C	R420	4C	8C			
C410	4B	8D	Q421	3D	8C	R421	3D	8C	R463	5F	8D
C414	2D	7B	Q422	2D	7C	R422	2C	7C	R464	4F	8D
C415	3D	8B	Q423	3D	8C	R423	3D	8C	R465	4F	9D
C420	1D	7C	Q428	2D	8B	R424	1C	7C	R467	4F	9D
C421	3D	8C	Q429	3D	8B	R426	2D	8C	R468	4F	8D
C453	3E	9C	Q446	3E	9C	R427	2D	8C	R469	4F	9D
C459	5B	8C	Q450	3E	8C	R428	2D	7B	R470	4F	8D
C460	1G	8D	Q473	4G	9C	R429	3D	9B	R473	4G	9B
C467	4F	8D	Q474	4G	9C	R431	3E	9B	R474	5G	10C
C469	4F	9C	Q476	4G	9D	R432	2D	9B	R476	4F	9D
C473	3F	9B	Q477	4G	9D	R433	3D	9B	R477	4F	9D
C487	4G	9C	Q487	4G	9C	R434	2C	9B	R478	5F	9C
C590	1F	8D				R435	3D	9B	R479	5F	9C
			R400	4B	7C	R436	2E	8A	R480	4G	9D
CR405	4B	8D	R402	4B	7D	R437	2E	8B	R481	4G	9D
CR406	4B	8D	R403	4B	7D	R439	3E	8C	R482	4G	9D
CR414	2C	8B	R404	4B	7C	R445	3E	8C	R486	4F	9D
CR415	2C	8C	R405	4B	7D	R446	3E	8C	R487	4G	9D
CR467	4F	9D	R406	4B	7D	R447	4E	8C	R492	4H	9D
CR476	3F	9B	R407	4C	8D	R450	3E	8C	R591	3G	9D
CR477	4F	9D	R408	5B	8E	R452	5F	8C			
J2223	2G	9B	R410	5B	8D	R453	4F	8C	TP460	4D	8D
J2223	5B	9B	R411	2C	8B	R455	5F	8C			
J2500	4H	10D	R412	3C	9B	R457	4E	9D	U426A	2D	7B
			R413	2C	8C	R458	4F	9D	U426B	2E	7B
Q400	4B	7C	R414	2C	8B	R459	5B	8C	U460	4F	8D
Q402	4B	7D	R415	2C	8C	R460	5E	8C			
Q405	4B	8D	R416	2C	8C	R461	5C	9D	W410	4B	7D
Q406	4B	8D	R417	3C	8C	R462	5B	9C			
Q413	3C	9B									

Partial A1 also shown on diagrams 1, 2, 3, 4, 6, 7, 8, 9, 10, and 11.

ASSEMBLY A3

R438	2H	7B	S460	5A	6B						

Partial A3 also shown on diagrams 1, 2, 3, 4, 6, 7, 8, 9, 10, and 11.



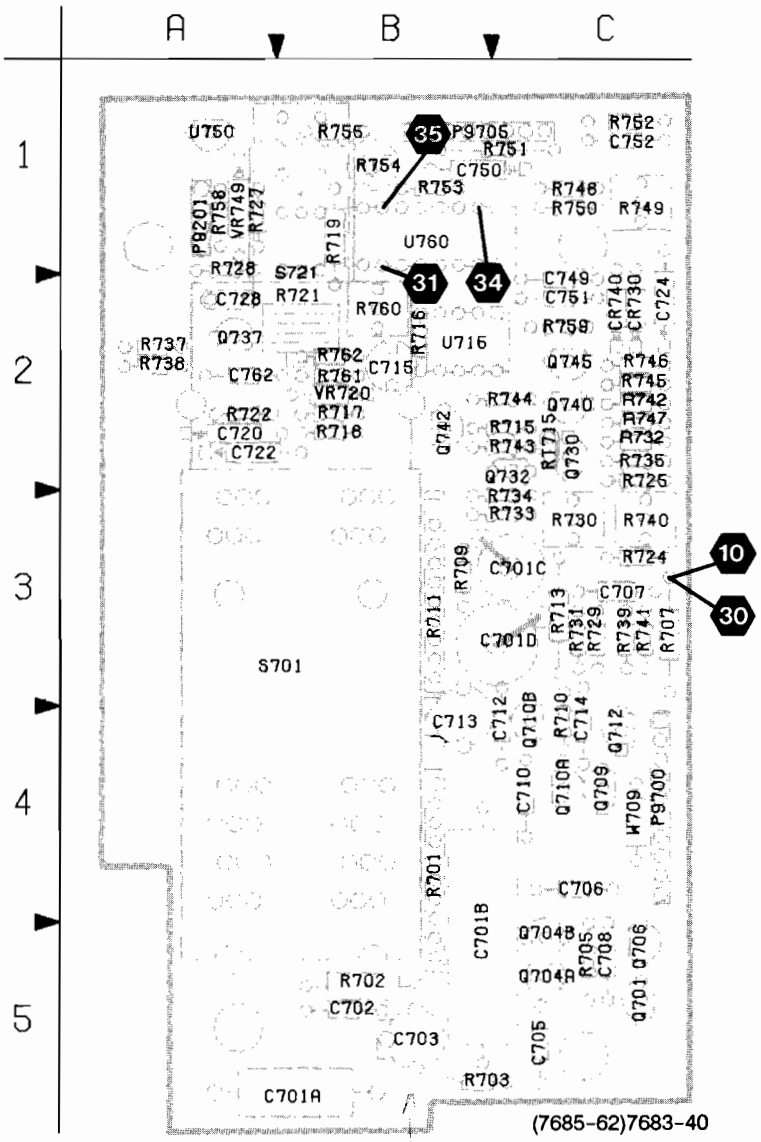
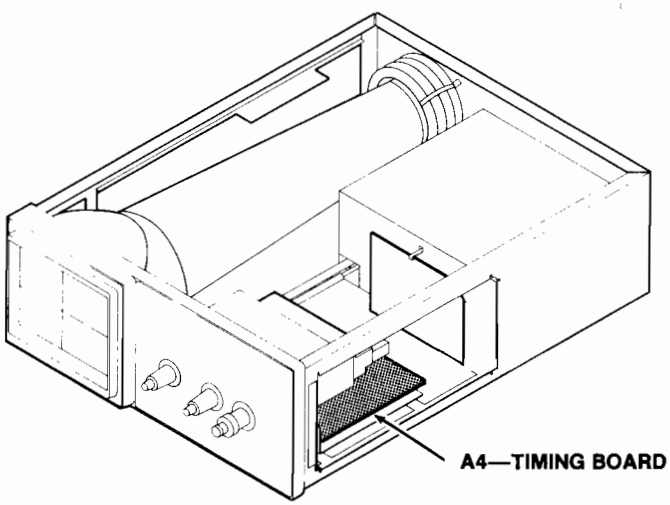


Figure 9-10. A4—Timing board.

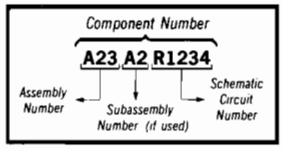


A4—TIMING BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C701	6	Q732	8	R742	8
C701	7	Q737	8	R743	8
C702	6	Q740	8	R744	8
C703	6	Q742	8	R745	8
C705	6	Q745	8	R746	8
C706	6			R747	8
C707	8	R701	6	R748	8
C708	6	R702	6	R749	8
C710	7	R703	6	R750	8
C712	7	R705	6	R751	8
C713	7	R707	6	R752	8
C714	7	R709	7	R753	8
C715	6	R710	7	R754	8
C720	6	R711	7	R755	8
C722	6	R713	7	R758	8
C724	8	R715	6	R759	8
C728	8	R716	6	R760	8
C749	8	R717	6	R761	8
C750	8	R718	6	R762	8
C751	8	R719	6		
C752	8	R721	6	RT715	6
C762	8	R722	6		
		R724	8	S701	6
CR730	8	R725	8	S701	7
CR740	8	R727	8	S721	6
		R728	8	S721	8
P9201	4	R729	8		
P9201	6	R730	8	U715	6
P9700	6	R731	8	U715	8
P9705	8	R732	8	U750	8
		R733	8	U760	8
Q701	6	R734	8		
Q704	6	R735	8	VR720	6
Q706	6	R737	8	VR749	8
Q709	7	R738	8		
Q710	7	R739	8	W709	7
Q712	7	R740	8		
Q730	8	R741	8		

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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

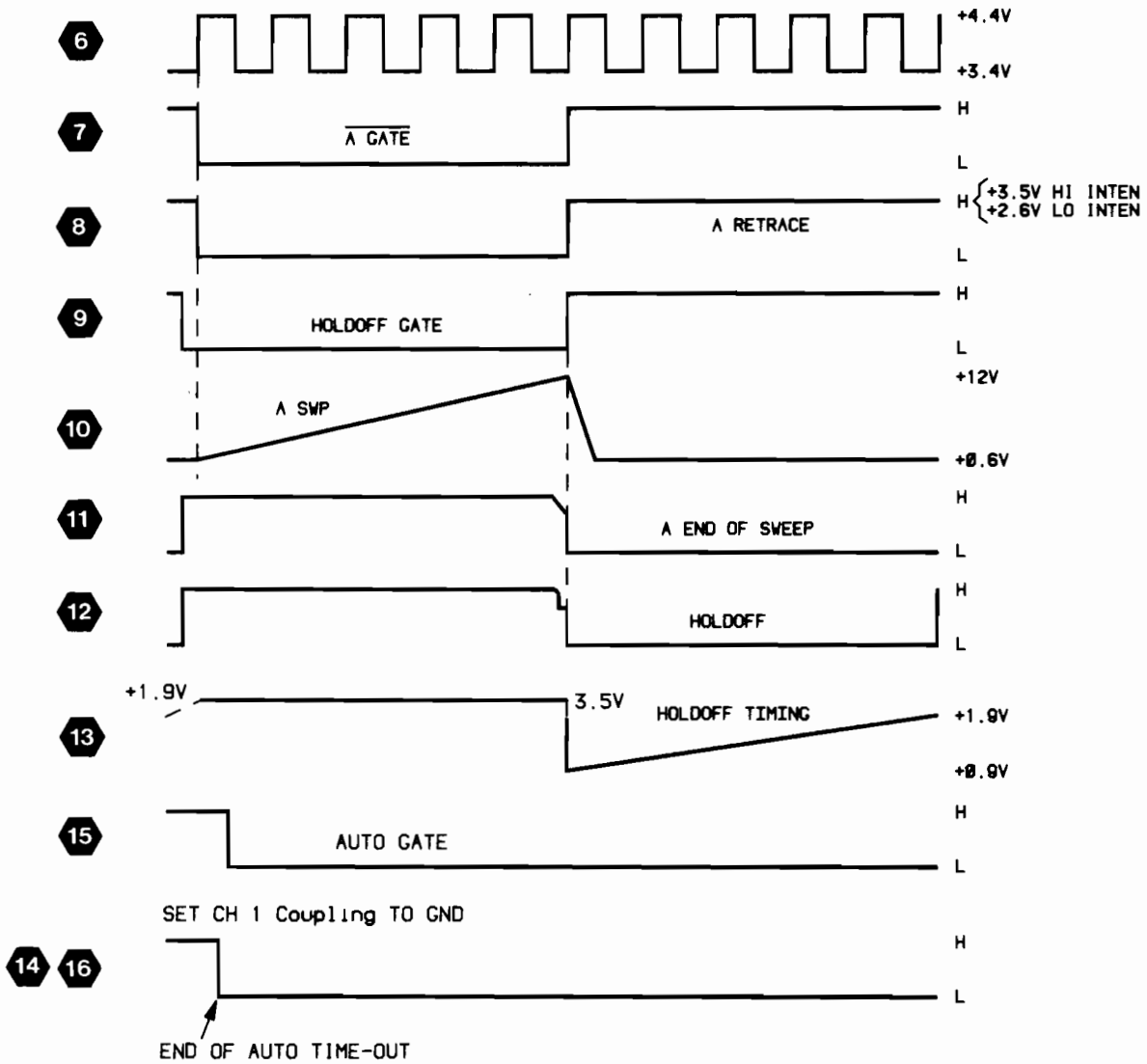
2235A CONTROL SETTINGS

DC Voltages

A INTENSITY	Midrange
Horizontal MODE	A
SEC/DIV	0.1 ms
A TRIGGER Mode	P-P AUTO

AC Waveforms

Vertical MODE	CH 1
CH 1 VOLTS/DIV	1V
CH 1 AC-GND-DC	DC
Horizontal MODE	A
A TRIGGER LEVEL	Midrange
A TRIGGER Mode	P-P AUTO
A & B SOURCE	VERT MODE
A SOURCE	NORM
CH 1 INPUT SIGNAL	1-kHz sine wave, 4V P-P



(4206-97)7683-41

A SWEEP GENERATOR AND LOGIC DIAGRAM 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
C500	5C	10C	J2222	4B	7B	R507	5C	10C	R572	4E	10F
C501	5B	10C	J2223	3B	9B	R508	5B	10D	R573	5E	10E
C502	3F	10C	J2223	4B	9B	R509	5C	10C	R574	3E	10F
C503	3G	7E	J2223	5B	9B	R511	5F	9E	R576	4F	9E
C504	3D	8E	J2223	5F	9B	R512	4F	9E	R577	4G	9E
C505	3B	8E	J2600	4H	9D	R513	4F	9E	R578	3G	9E
C506	3G	9F	J2850	3H	8E	R514	4F	9F	R580	4F	8F
C517	4D	7E	J2850	8E	8E	R516	5F	10E	R582	4G	8E
C518	3C	8F				R517	5F	10E			
C519	3D	8F	Q501	5B	10D	R518	3E	9E	TP504	3D	7F
C520	3C	8F	Q509	5C	10C	R523	4C	8F	U502	5C	10C
C525	4G	8F	Q511	4F	9E	R524	4C	8F	U504A	3D	8E
C527	4G	9F	Q525	4D	7F	R525	5G	8F	U504B	3C	8E
C529	4G	10F	Q555	4C	7E	R526	3D	9F	U506A	3F	9E
C531	3F	10D	Q576	4F	8E	R527	4G	9F	U506B	4E	9E
			Q578	4G	8E	R528	3D	10E	U532A	5E	10F
CR501	5B	10D				R529	4G	10F	U532B	3D	10E
CR502	5B	10D	R500	5B	10D	R554	4C	7E	U532C	4E	10E
CR503	3D	8E	5501	5B	10D	R555	4C	7E	U532D	4C	10E
CR508	4B	9B	R502	5C	10D	R568	4C	10E			
CR509	5C	10C	R503	5C	10D	R569	5C	10D	W9700	3C	9F
CR514	4F	9E	R504	3D	8E	R569	5C	10D			
CR518	4D	7E	R505	3B	7E	R571	5D	9E			
CR529	4G	9F	R506	5B	10D						

Partial A1 also shown on diagram 1, 2, 3, 4, 5, 7, 8, 9, 10, and 11.

ASSEMBLY A3

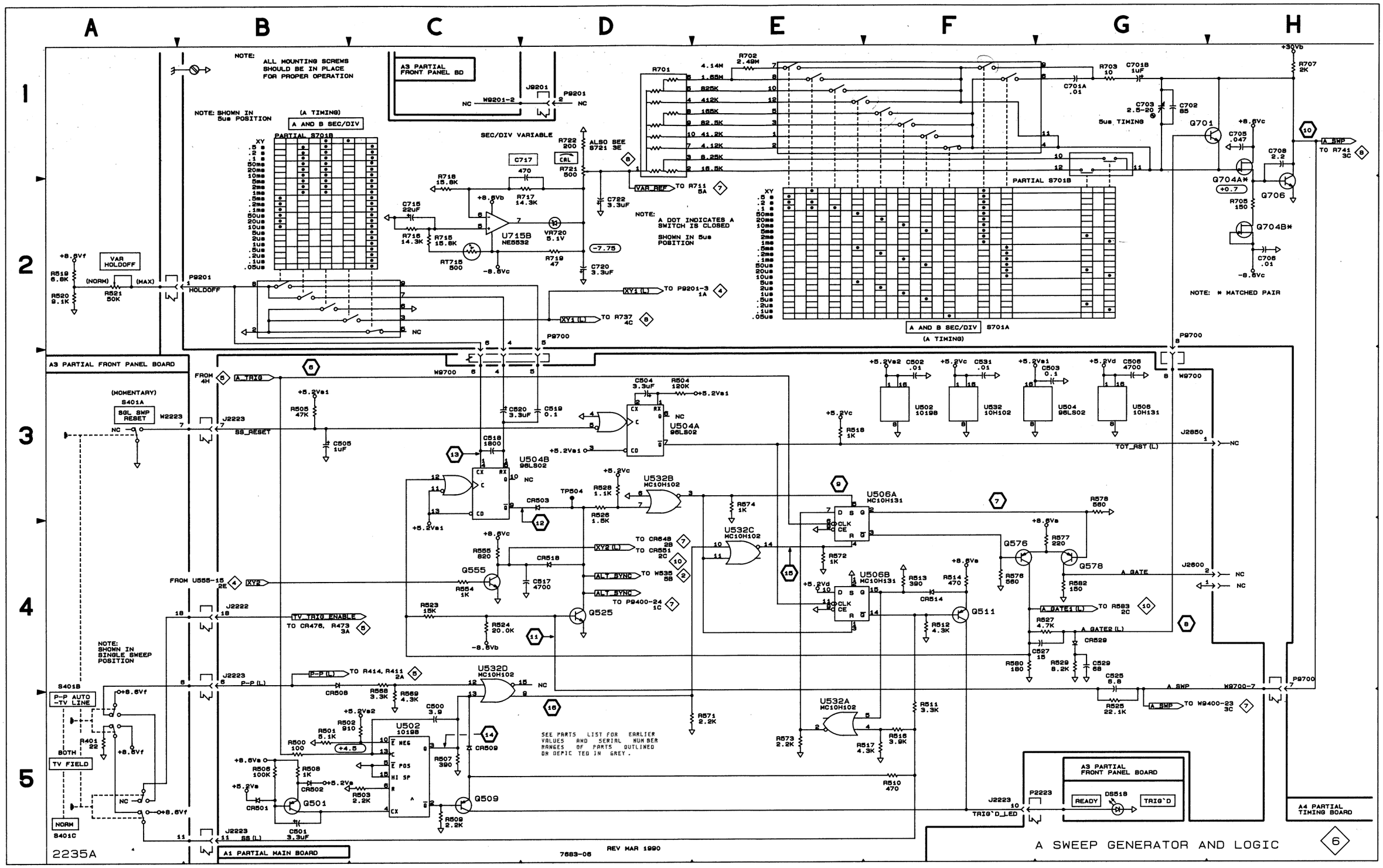
DS518	5G	6C	R519	2A	6C	R723	1C	6C	S401B	5A	7C
			R520	2A	6C				S401C	5A	7C
R401	5A	7C	R521	2A	7D	S401A	3A	6C			

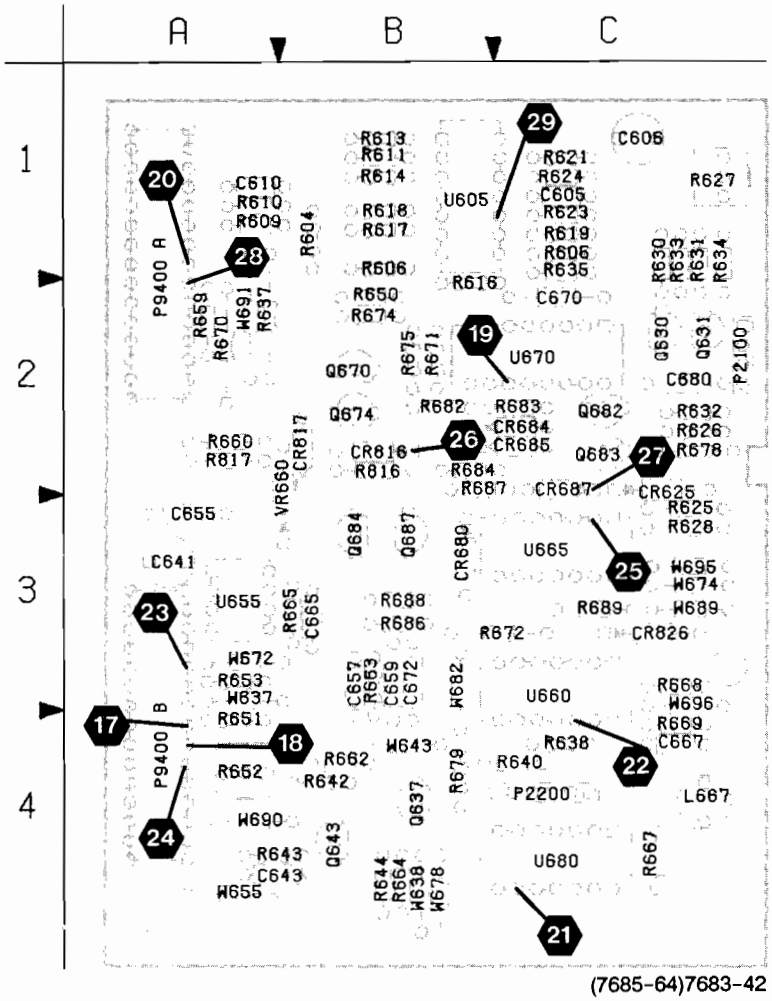
Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 7, 8, 9, 10, and 11.

ASSEMBLY A4

C701A	1G	5A	P9201	1D	1A	R701	1D	4B	R721	1D	2B
C701B	1G	5B	P9201	2A	1A	R702	1E	5B	R722	1D	2A
C702	1G	5B	P9700	2C	4C	R703	1G	5B	RT715	2C	2C
C703	1G	5B	P9700	3D	4C	R705	2H	5C			
C705	1H	5C	P9700	4G	4C	R707	1H	3C	S701A	1F	3A
C706	2H	4C	P9700	4H	4C	R715	2C	2C	S701B	1B	3A
C708	1H	5C				R716	2C	2B	S701B	2G	3A
C715	2C	2B	Q701	1G	5C	R717	2C	2B			
C720	2D	2A	Q704A	1H	5C	R718	2C	2B	U715B	2C	2B
C722	2D	2A	Q704B	2H	5C	R719	2D	1B			
			Q706	1H	5C				VR720	2D	2B

Partial A4 also shown on diagrams 4, 7, and 8.

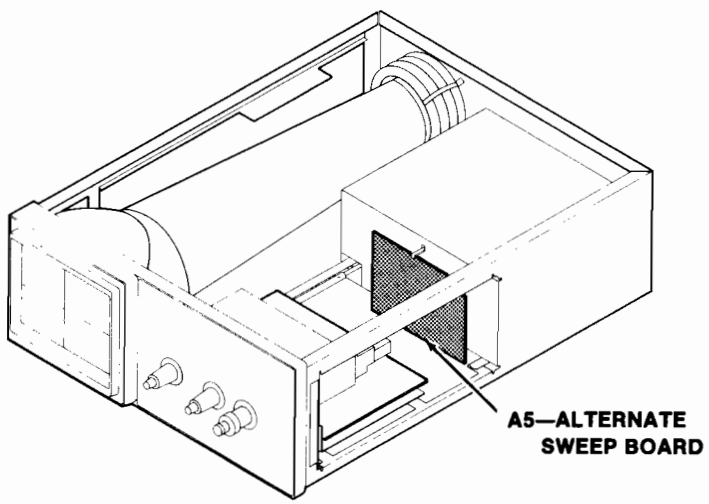




(7685-64)7683-42

FIG. 9-11

Figure 9-11. A5—Alternate Sweep board.

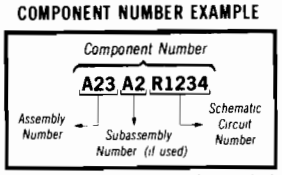


A5 – ALTERNATE SWEEP BOARD

CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C605	7	Q637	7	R634	7	R687	7
C606	7	Q643	7	R635	7	R688	7
C610	7	Q670	7	R637	7	R689	7
C641	7	Q674	7	R638	7	R816	7
C643	7	Q682	7	R640	7	R817	7
C655	7	Q683	7	R642	7		
C657	7	Q684	7	R643	7	U605	7
C659	7	Q687	7	R644	7	U655	7
C665	7			R650	7	U660	7
C667	7	R604	7	R651	7	U665	7
C670	7	R605	7	R652	7	U670	7
C672	7	R606	7	R653	7	U680	7
C680	7	R609	7	R659	7		
		R610	7	R660	7	VR660	7
CR625	7	R611	7	R662	7		
CR680	7	R613	7	R663	7	W637	7
CR684	7	R614	7	R664	7	W638	7
CR685	7	R616	7	R665	7	W643	7
CR687	7	R617	7	R667	7	W655	7
CR816	7	R618	7	R668	7	W655	11
CR817	7	R619	7	R669	7	W672	7
CR826	7	R621	7	R670	7	W674	7
		R623	7	R671	7	W678	7
L667	7	R624	7	R672	7	W682	7
		R625	7	R674	7	W689	7
P2100	7	R626	7	R675	7	W690	7
P2200	7	R627	7	R678	7	W690	11
P9400	7	R628	7	R679	7	W691	7
P9400	11	R630	7	R682	7	W691	11
		R631	7	R683	7	W695	7
Q630	7	R632	7	R684	7	W696	7
Q631	7	R633	7	R686	7		

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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

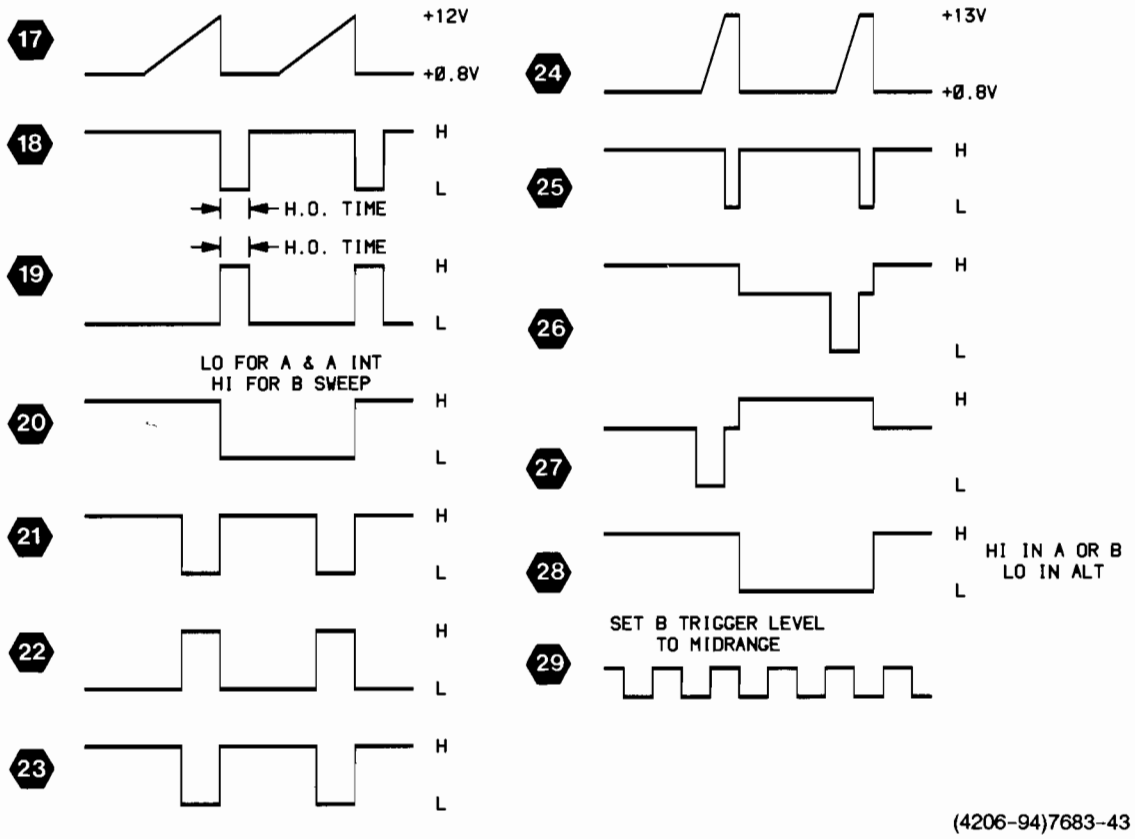
2235A CONTROL SETTINGS

DC Voltages

AC-GND-DC (both)	GND
A TRIGGER Mode	NORM (sweep not running)

AC Waveforms

Vertical MODE	CH 1
CH 1 VOLTS/DIV	5mV
AC-GND-DC (both)	DC
Horizontal MODE	ALT
A SEC/DIV	50 µs
B SEC/DIV	5 µs
B DELAY TIME POSITION	MIDRANGE
B TRIGGER LEVEL	CW-RUNS AFTER DLY
A TRIGGER Mode	P-P AUTO
A & B SOURCE	CH 1
A SOURCE	NORM
CH 1 INPUT SIGNAL	5-div, 1-kHz sine wave



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B TIMING AND ALTERNATE B SWEEP DIAGRAM 7

ASSEMBLY A1

CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION	CIRCUIT NUMBER	SCHEM LOCATION	BOARD LOCATION
C603	4D	7G	CR641	3E	10F	R645	3B	10F	VR712	4C	10F
C635	1C	9G	CR647	2C	11E	R646	3B	10F			
C646	3B	11F	CR712	3C	10F	R647	3B	10F	W602	4D	8G
C647	2C	8F				R648	1C	10E	W603	5D	8G
C648	1C	8G	J2300	1D	10F	R649	2C	10E	W634	2B	10G
C649	2C	7G	J9400	1D	7G	R673	4C	9G	W635	2B	9G
C673	4C	9G	Q641	3C	11F				W648	1B	11G
CR648	2C	8F	R641	3C	9G	VR645	3B	10F	W649	2B	8G
									W9700	3C	9F

Partial A1 also shown on diagram 1, 2, 3, 4, 5, 6, 8, 9, 10,, and 11.

ASSEMBLY A3

R602	5D	7C	S602	5D	6C	S648	2A	5C			

Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6, 8, 9, 10, and 11.

ASSEMBLY A4

C701C	5C	3C	C714	5C	4C	Q712	5C	4C	R713	4C	3C
C701D	5C	3B									
C710	5C	4C	Q709	5C	4C	R709	5C	3B	S701C	4A	3A
C712	5C	4C	Q710A	5C	4C	R710	5C	4C			
C713	5C	4B	Q710B	5C	4C	R711	4A	3B	W709	5C	4C

Partial A4 also shown on diagrams 4, 6, and 8.

ASSEMBLY A5

C605	5F	1C	Q670	1E	2B	R640	4F	4C	U605	5E	1B
C606	5E	1C	Q674	2E	2B	R642	4E	4B	U655	3D	3A
C610	4E	1A	Q682	1F	2C	R643	4E	4A	U660A	3F	3C
C641	3D	3A	Q683	1G	2C	R644	3E	4B	U660B	3F	3C
C643	4E	4A	Q684	2G	3B	R650	2E	2B	U660C	3G	3C
C655	3E	3A	Q687	2G	3B	R651	3D	4A	U660D	4F	3C
C657	3D	3B				R652	3D	4A	U660E	1D	3C
C659	3E	3B	R604	5E	1B	R653	4D	3A	U660F	3E	3C
C665	3E	3B	R605	5E	1C	R659	2H	2A	U665A	4G	3C
C667	1E	4C	R606	5E	1B	R660	3D	2A	U665B	2G	3C
C670	5F	2C	R609	4E	1A	R662	3E	4B	U665C	2G	3C
C672	4E	3B	R610	4E	1A	R663	3D	3B	U665D	3G	3C
C680	1H	2C	R611	5E	1B	R664	3E	4B	U670A	3F	2C
			R613	5F	1B	R665	3E	3B	U670B	2F	2C
CR625	3F	3C	R614	5F	1B	R667	1E	4C	U680A	2E	4C
CR680	3G	3B	R616	5E	2B	R668	1D	3C	U680B	2E	4C
CR684	2G	2C	R617	5E	1B	R669	2E	4C	U680C	3E	4C
CR685	2G	2C	R618	5E	1B	R670	1E	2A	U680D	3E	4C
CR687	3G	3C	R619	5F	1C	R671	1F	2B			
CR816	2H	2B	R621	5F	1C	R672	4F	3B	VR660	3D	3B
CR817	3H	2B	R623	5F	1C	R674	2E	2B			
CR826	3F	3C	R624	5F	1C	R675	2E	2B	W637	2D	3A
			R625	3F	3C	R678	1F	2C	W638	1G	4B
L667	1E	4C	R626	3F	2C	R679	3H	4B	W643	4F	4B
			R627	5F	1C	R682	2F	2B	W655	1H	4A
P2100	4H	2D	R628	3F	3C	R683	2F	2C	W672	4E	3A
P2200	4E	4C	R630	3G	2C	R684	2F	2B	W674	4G	3C
P9400A	1D	2A	R631	3G	2C	R686	2F	3B	W678	2D	4B
P9400B	1D	4A	R632	3G	2C	R687	2G	3B	W682	3G	3B
			R633	4G	2C	R688	2G	3B	W689	1G	3C
Q630	3G	2C	R634	3G	2D	R689	2G	3C	W690	1H	4A
Q631	3G	2C	R635	4G	1C	R816	3H	2B	W691	1G	2A
Q637	4E	4B	R637	4E	2A	R817	3H	2A	W695	5G	3C
Q643	4E	4B	R638	4E	4C				W696	5G	3C

Partial A5 also shown on diagram 11.

OTHER PARTS

R9644	3B	CHASSIS									

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B TIMING AND ALTERNATE B SWEEP

2235A

7683-07

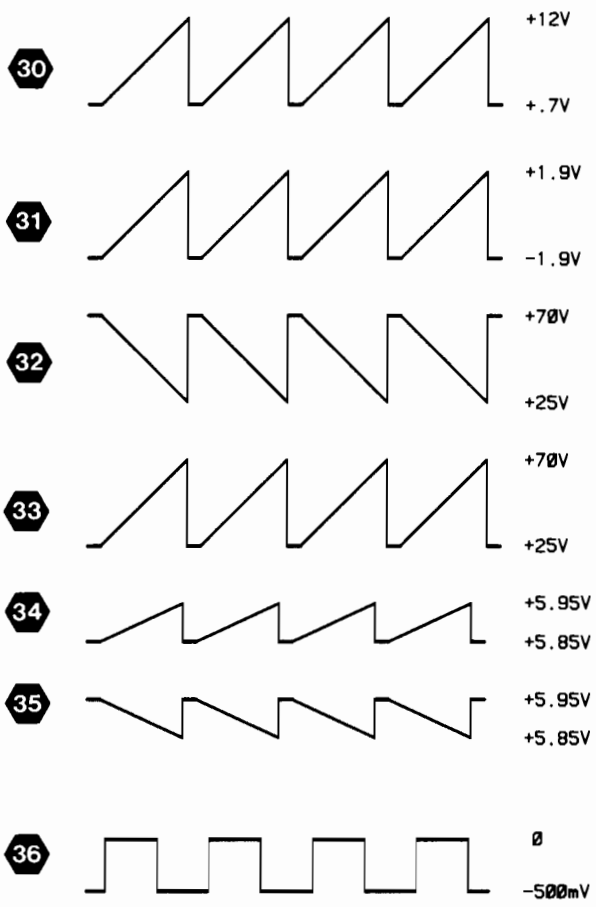
2235A CONTROL SETTINGS

DC Voltages

AC-GND-DC (both)	GND
Horizontal MODE	A
A TRIGGER Mode	P-P AUTO

AC Waveforms

AC-GND-DC (both)	GND
Horizontal MODE	A
X10 Magnifier	Off (knob in)
VAR HOLDOFFF	MIN (fully ccw)
A TRIGGER Mode	P-P AUTO



(4206-95)7683-44

CALIBRATOR AND HORIZONTAL OUTPUT AMPLIFIER DIAGRAM 8

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	4F	4J	Q770	4F	3H	R777	4H	4G	R989	2F	2C
C771	4G	4H	Q775	5H	3G	R778	5H	3G	R990	2F	1C
C774	4G	3H	Q778	3F	3H	R779	4H	4G	R991	2G	2B
C775	4G	4H	Q779	4H	4G	R780	3F	3H			
C777	4H	4G	Q780	3F	3H	R781	3F	5G	U985A	1F	2B
C779	4G	3G	Q785	3H	3G	R782	3F	2H	U985B	2F	2B
C781	3G	3H	Q789	3H	3G	R783	3H	3H	U985C	2F	2B
C782	3G	2H				R784	3F	3J	U985D	2G	2B
C785	3G	3H	R566	3B	7F	R785	3G	3H	U985E	2G	2B
C787	3H	3H	R676	3B	7F	R786	2H	3G	U985F	1G	2B
C789	3G	2G	R764	4F	3J	R787	3H	3G			
C987	1F	2C	R766	4F	3H	R788	3H	3G	VR764	4F	3J
			R768	4F	3H	R789	3H	3G	VR782	3G	2H
CR764	4F	2J	R770	4F	4H	R792	4H	4G			
CR770	4F	4J	R771	4F	5G	R793	4H	4H	W732	3B	8F
CR780	3F	3J	R772	4F	3H	R984	2G	1B	W9700	3B	9F
			R773	5H	3G	R985	1F	2B	W9705	2B	7F
J9884	2G	4B	R774	4G	3H	R986	1F	2B	W9778	5H	3G
			R775	5G	4H	R987	1F	2B	W9788	3H	3G
Q768	4F	3H	R776	4H	4G	R988	2F	2B			

Partial A1 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 9, 10, and 11.

ASSEMBLY A3

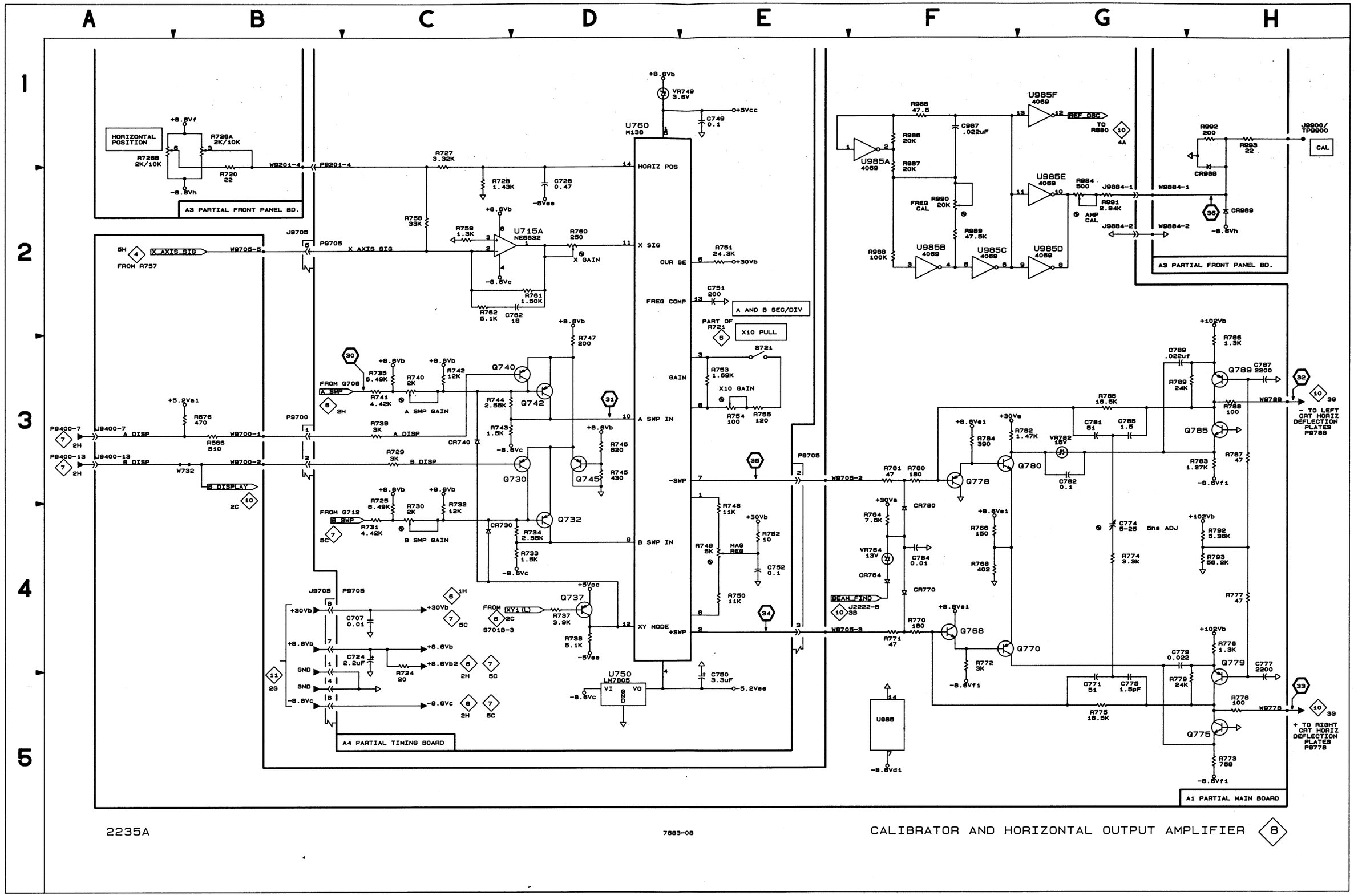
CR988	1H	2D	J9900	1H	2C	R726A	1B	5C	R993	1H	2D
CR989	2H	2D				R726B	1A	5C			
			R720	1B	6C	R992	1H	1B	W9884	2G	1A

Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 9, 10, and 11.

ASSEMBLY A4

C707	4C	3C	Q737	4D	2A	R737	4D	2A	R753	3E	1B
C724	4C	2C	Q740	3D	2C	R738	4D	2A	R754	3E	1B
C728	2D	2A	Q742	3D	2B	R739	3C	3C	R755	3E	1B
C749	1E	2C	Q745	3D	2C	R740	3C	3C	R758	2C	1A
C750	4E	1B				R741	3C	3C	R759	2C	2C
C751	2E	2C	R724	5C	3C	R742	3C	2C	R760	2D	2B
C752	4E	1C	R725	3C	2C	R743	3C	2C	R761	2D	2B
C762	2D	2A	R727	1C	1A	R744	3C	2B	R762	2C	2B
			R728	2C	1A	R745	3D	2C			
CR730	4C	2C	R729	3C	3C	R746	3D	2C	S721	3E	1B
CR740	3C	2C	R730	4C	3C	R747	2D	2C			
			R731	4C	3C	R748	3E	1C	U715A	2C	2B
P9705	2B	1B	R732	3C	2C	R749	4E	1C	U750	5D	1A
			R733	4D	3C	R750	4E	1C	U760	1D	1B
Q730	3D	2C	R734	4D	3B	R751	2E	1B			
Q732	4D	2B	R735	3C	2C	R752	4E	1C	VR749	1D	1A

Partial A4 also shown on diagrams 4, 6, and 7.



2235A 7683-08 CALIBRATOR AND HORIZONTAL OUTPUT AMPLIFIER 8

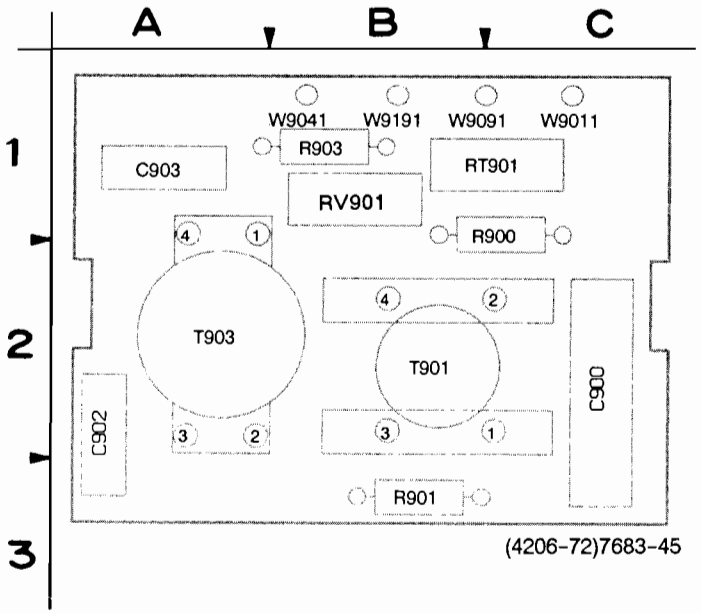


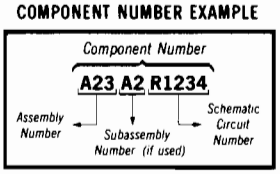
Figure 9-12. A6—Line Filter board.

A6—LINE FILTER BOARD

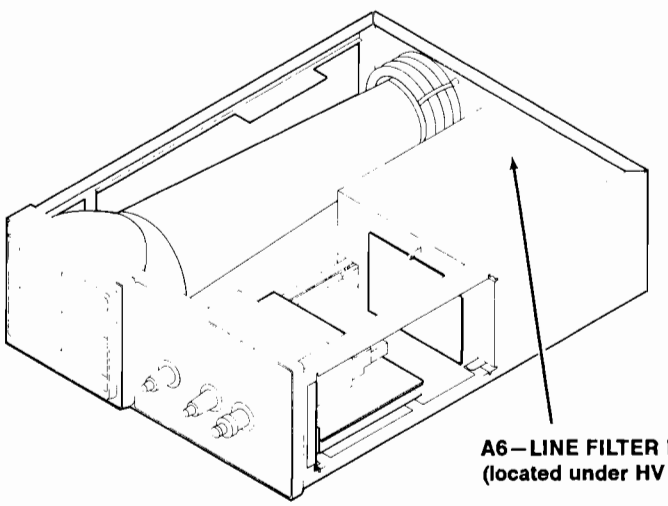
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
C900	9	RV901	9
C902	9		
C903	9	T901	9
		T903	9
R900	9		
R901	9	W9011	9
R903	9	W9041	9
		W9091	9
RT901	9	W9191	9

Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE



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



A6—LINE FILTER BOARD (located under HV Shield)

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 exits 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.

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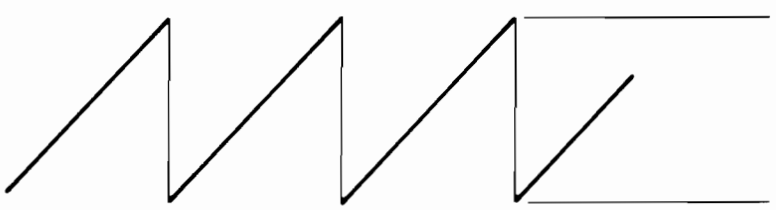

PROBE GROUND LEAD ON TP940

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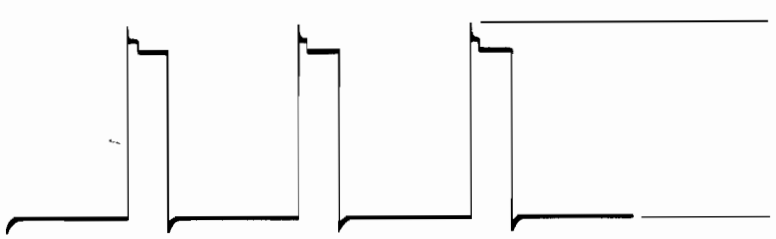

PROBE GROUND LEAD ON TP940

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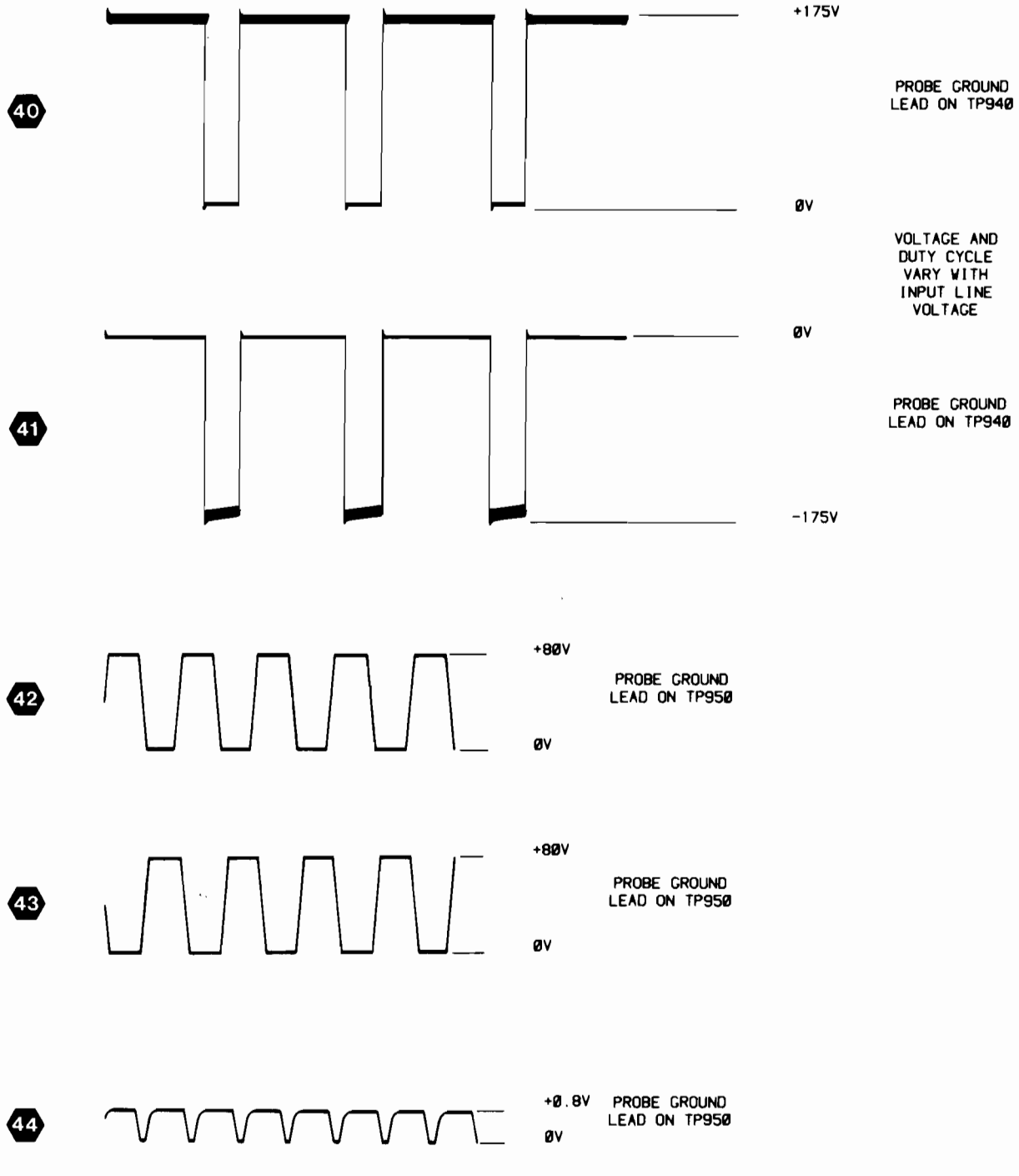
PROBE GROUND LEAD ON TP940



(4204-61)7683-46

POWER INPUT, PREREGULATOR, AND INVERTER DIAGRAM 9

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	2C	4K	CR948	5E	10M	R912	4C	9L	R946	5F	10L
C904	1D	5M				R913	3C	9M			
C906	1E	6L	E907	4F	7K	R914	3D	9L	R947	4F	9L
C907	2F	7M				R915	3D	10L	R948	5E	10N
C908	2F	7M	P908	3F	7L	R916	3D	10M	R949	4G	10L
C917	3D	10L	P909	3F	9L	R917	3D	9L			
C919	3E	10L	P940	3F	8L	R919	3D	10M	S901	1C	5M
C922	3D	10L				R921	3D	9M			
C925	2D	10L	Q908	3F	9L	R922	3D	10M	T390	2D	6L
C940	4F	8K	Q928	2E	9M	R925	2E	9M	T906	2G	8L
C941	4F	8K	Q930	2E	9M	R926	1D	9N	T944	4F	9K
C942	5D	10L	Q935	4C	11M	R927	2E	9M			
C943	4D	10L	Q938	4E	10L	R928	2E	9M	TP940	4D	10M
C945	2D	10M	Q939	4E	10L	R929	2E	9M	TP950	5D	9L
C944	5F	9L	Q944	4E	10L	R930	2E	9M			
			Q946	5G	10K	R935	5D	11M	U930	3E	10M
CR901	1D	6M	Q947	4G	10K	R937	4D	11L			
CR902	1D	6M				R938	4D	11M	VR925	2E	9M
CR903	1D	6M	R397	2C	6G	R939	5D	11L	VR035	4D	11M
CR904	1D	6M	R398	2C	6G	R940	5D	10L	VR943	4E	10L
CR907	2G	8K	R905	2C	5L	R941	4E	10M			
CR908	3F	9L	R906	2D	6L	R942	4E	10L	W9040	1C	6L
CR920	2F	9M	R907	4G	8K	R943	5E	10L	W9190	2C	6L
CR946	5G	11K	R908	3F	9L	R944	4E	10M			
CR947	4G	10K	R909	3F	9L	R945	4F	10M			

Partial A1 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8, 10, and 11.

ASSEMBLY A3

DS915	4B	1A	R910	3B	1C						

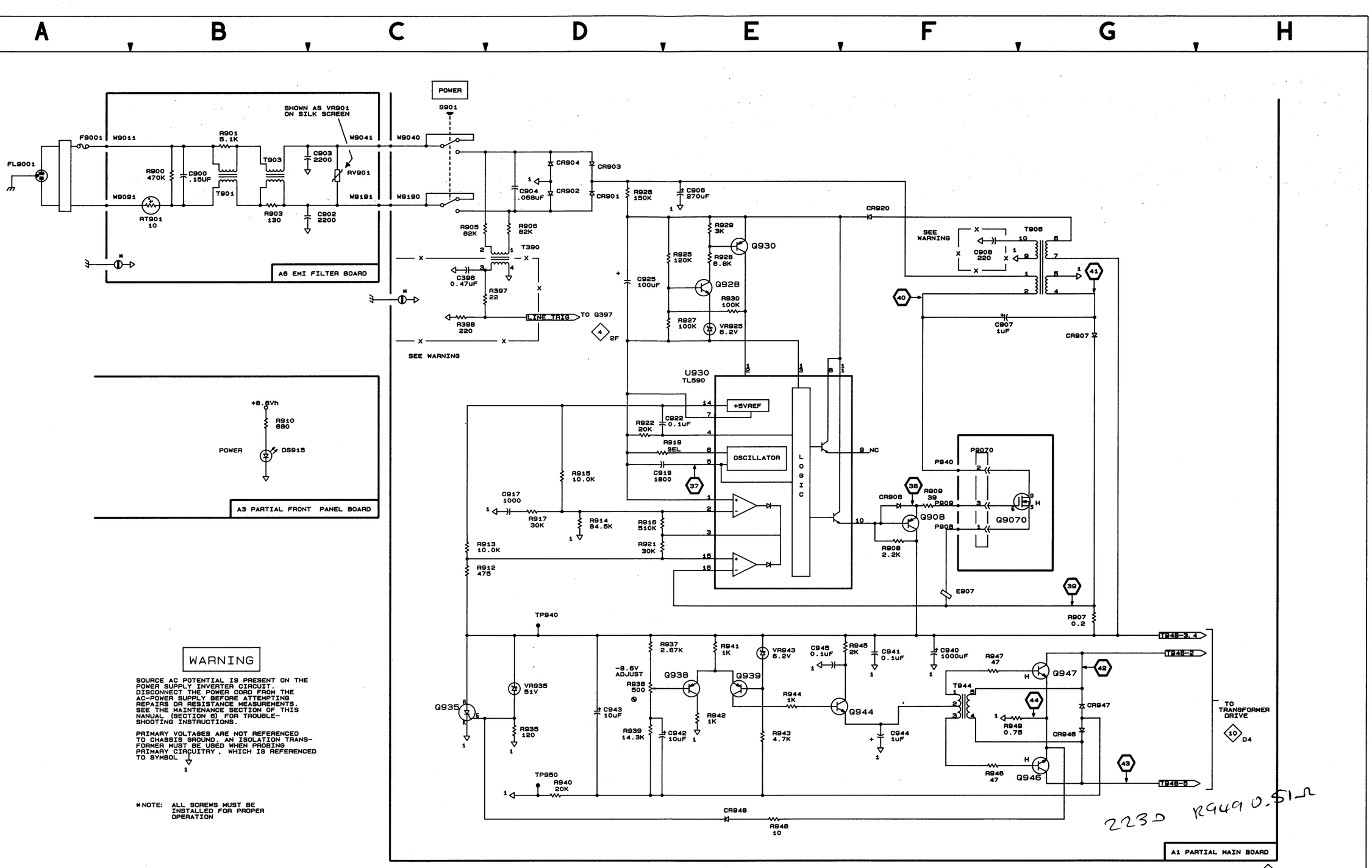
Partial A3 also shown on diagrams 1, 2, 3, 4, 5 6, 7, 8, 10, and 11.

ASSEMBLY A6

C900	1B	1B	R901	1B	2B	RV901	1C	2A	W9011	1A	1A
C902	2B	3B	R903	2B	2A				W9041	1C	2A
C903	1B	3A				T901	1B	2B	W9091	2A	2A
			RT901	2B	2A	T903	1B	3B	W9191	2C	2A
R900	1B	2A									

OTHER PARTS

F9001	1A	CHASSIS	FL9001	1A	CHASSIS	Q9070	3F	CHASSIS			



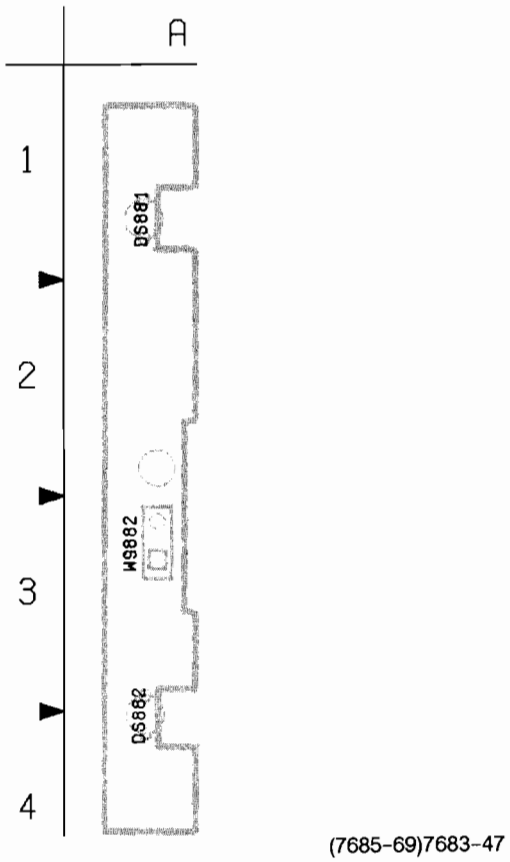
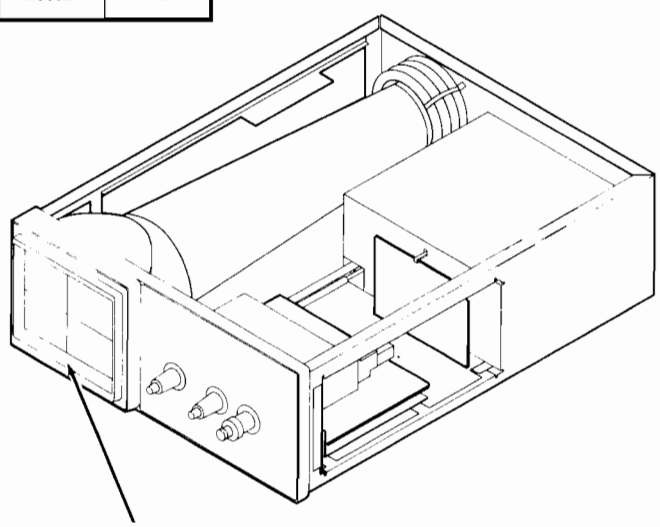


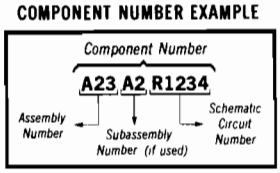
Figure 9-13. A7—Scale Illum board.

A7—SCALE ILLUM BOARD			
CIRCUIT NUMBER	SCHEM NUMBER	CIRCUIT NUMBER	SCHEM NUMBER
DS881	10		
DS882	10	W9882	10



Static Sensitive Devices
See Maintenance Section

COMPONENT NUMBER EXAMPLE

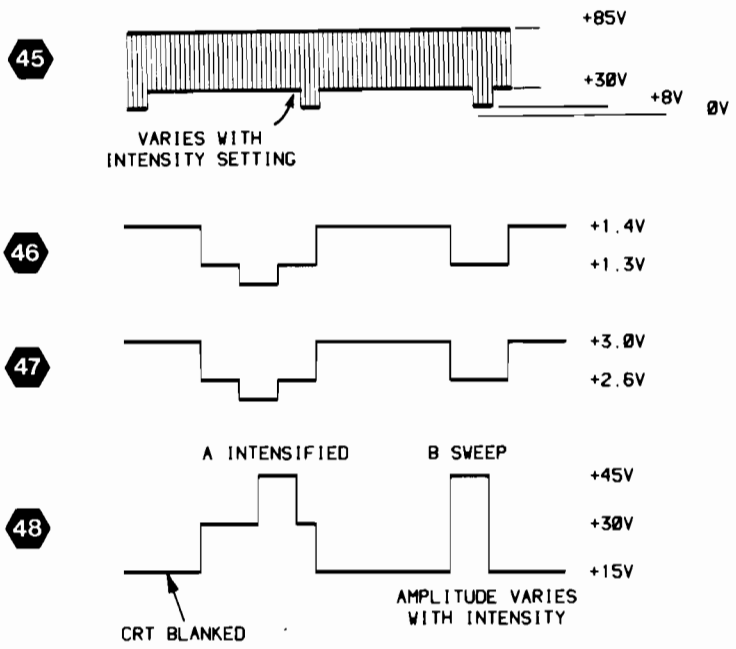


Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

2235A CONTROL SETTINGS

AC Waveforms

Vertical MODE	CH 1
CH 1 VOLTS/DIV	5mV
AC-GND-DC	DC
Horizontal MODE	ALT
A SEC/DIV	50 µs
B SEC/DIV	5 µs
B DELAY TIME POSITION	5.0
B TRIGGER LEVEL	RUNS AFTER DLY-CW
A TRIGGER Mode	P-P AUTO
A & B SOURCE	CH 1
A SOURCE	NORM
CH 1 INPUT SIGNAL	1-kHz sine wave, 5 div



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POWER SUPPLY SECONDARIES, Z AXIS, AND CRT DIAGRAM 10

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
C824	1E	7F	CR851	4F	5L	Q845	1F	3M	R871	2H	1K
C825	1E	3L	CR853	4F	5L	Q882	4C	2B	R872	3H	1K
C828	2E	4L	CR854	3F	7J	Q885	2D	5K	R873	3H	1K
C832	1F	3L	CR855	3F	7J				R874	3H	1K
C835	2F	4L	CR882	4C	3B	R583	2C	8F	R875	3H	1K
C845	2F	4M	CR954	3D	9H	R586	2C	8F	R877	4H	1K
C846	1F	3M	CR955	4D	9H	R804	2B	6E	R880	4A	2B
C847	1F	3M	CR956	3D	9H	R805	2B	6F	R881	5C	5B
C849	1F	4N	CR957	4D	9H	R814	2B	6E	R883	5A	3C
C851	4F	4L	CR960	4D	9H	R818	2C	7F	R884	5B	3C
C853	4F	7H	CR961	5D	9H	R820	2C	7F	R885	2D	5K
C854	4F	7J	CR962	5E	9H	R822	1C	3M	R886	2D	5J
C855	3F	7K	CR963	5D	9H	R823	1D	2M	R887	4B	3B
C871	2H	1L	CR967	5D	9J	R825	1E	4L	R888	3B	2C
C873	3H	1L	CR970	5D	9J	R826	1E	2M	R889	4B	2C
C875	4H	1K				R828	2E	2K	R890	3F	6H
C877	4H	1L	DS856	3F	7J	R830	1E	3M	R891	3B	2C
C881	5B	4B	DS858	3F	7J	R832	1F	3M	R893	4F	5H
C882	4B	3B	DS870	4E	7H	R834	2F	4L	R975	3E	6K
C893	4F	6H				R835	2E	4L	R976	3E	6J
C954	3E	8H	J2700	5G	8G	R836	2F	4L	R978	3E	6J
C956	4E	8H	J9870B	2G	1L	R840	2F	4L			
C957	4E	7H	J9882	5C	3B	R841	2F	4M	T948	3D	8J
C968	5E	9J				R842	2F	4M			
C975	3E	6K	L956	3E	7H	R843	2F	4L	TP842	2F	4L
C976	3E	6K				R844	1F	3M			
C979	3F	6J	P870	5F	7H	R845	1F	3M	U882A	4B	3B
			P871	4E	7H	R846	1F	3M	U882B	4B	3B
CR551	2C	7F				R849	1F	3M	U975	3D	5J
CR805	2B	6F	Q583	2C	8F	R851	4F	4M			
CR818	2D	7F	Q586	2C	8F	R852	4F	4M	VR828	2E	3L
CR820	2D	7F	Q804	2B	6F	R853	4F	7H			
CR823	1D	3L	Q814	2B	6F	R854	4F	7J	W262	3D	5B
CR824	1E	2M	Q825	1E	3L	R855	4F	4L	W881	5C	5F
CR825	1E	3M	Q829	1F	3M	R858	3F	7J	W885	2D	5J
CR829	1E	3M	Q835	2F	4M	R860	3F	7H	W948	5E	9J
CR840	2F	4M	Q840	2F	4M	R870	2H	1K	W9800	1B	4N
CR845	1F	3M							W9870	4G	6H

Partial A1 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8, 9, and 11.

ASSEMBLY A3

J9006	2H	1C	R802B	2A	1C	R983	2H	1C	W90	5E	3B
			R810	1A	1C				W91	5E	3B
R800	1A	1C	R882	3A	1B	S390	2A	1B			
R802A	2A	1C	R982	2H	1C						

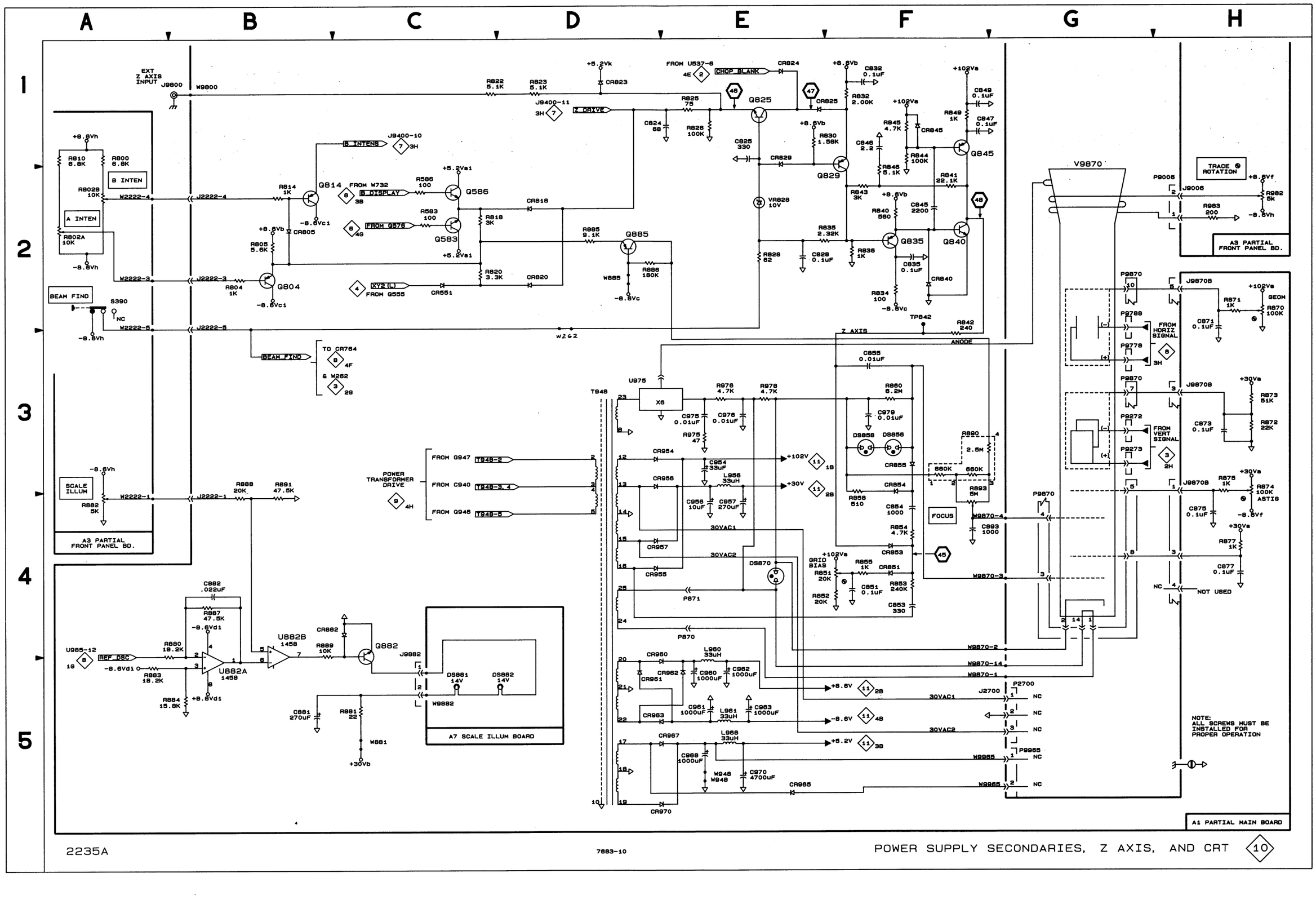
Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8, 9, and 11.

ASSEMBLY A7

DS881	5C	1A	DS882	5D	4A	W9882	5C	3A			

OTHER PARTS

B1	5G	CHASSIS	J9800	1B	CHASSIS	V9870	2G	CHASSIS			



POWER DISTRIBUTION DIAGRAM 11

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
C200	2D	4F	J2400	2B	10F	W408	5C	9B	W968	3C	10G
C201	4E	4F	J9400	3G	7G	W494	2C	6E	W971	2C	9F
C220	3D	2E				W499	4D	7E	W972	2C	7F
C274	2C	2J	L451	5C	7E	W591	4E	9E	W974	2E	3L
C451	5D	8E	L499	4C	6F	W592	4E	10F	W975	2E	3K
C494	3C	6E				W954	1C	7G	W976	4C	9G
C499	4D	6D	R220	2D	2E	W955	1C	4L	W977	4C	7G
C507	4D	7C	R494	2C	7F	W955	5C	4L	W979	4E	3K
C540	4C	2L	R796	4E	3J	W956	2C	6G	W991	3C	7B
C796	5F	3J	R797	2E	3J	W957	2B	9G	W993	5C	7C
C797	3E	3J	R799	1C	4G	W959	1C	5G	W995	5C	9B
C799	1C	4G	R964	3C	4L	W960	2B	10G	W997	2D	5F
						W961	4B	10G	W998	4D	5F
E200	2D	5F	TP961	4B	10F	W964	2C	4L	W999	5D	3F
E201	4D	5F				W965	1C	3K	W9705	2G	7F
E272	2C	2J	W272	2C	1J	W965	2C	3K	W9991	5G	7F
E590	3D	10D				W966	3D	9F			

Partial A1 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8, 9, AND 10.

ASSEMBLY A3

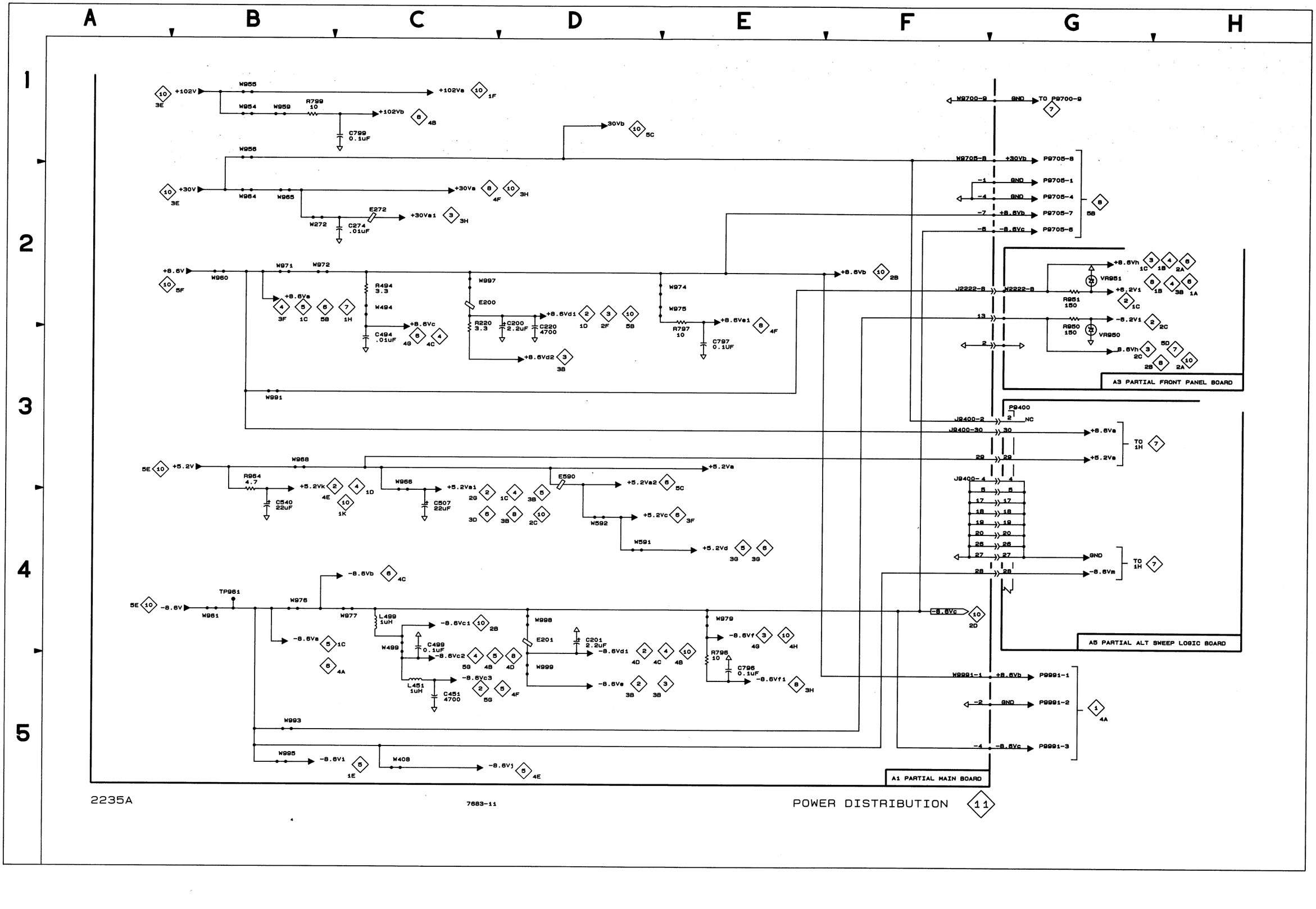
R950	2H	5D	R951	2H	6D	VR950	2H	5D	VR951	2H	7D

Partial A3 also shown on diagrams 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10.

ASSEMBLY A5

P9400A	3G	2A	P9400B	3G	4A						

Partial A4 also shown on diagram 7.



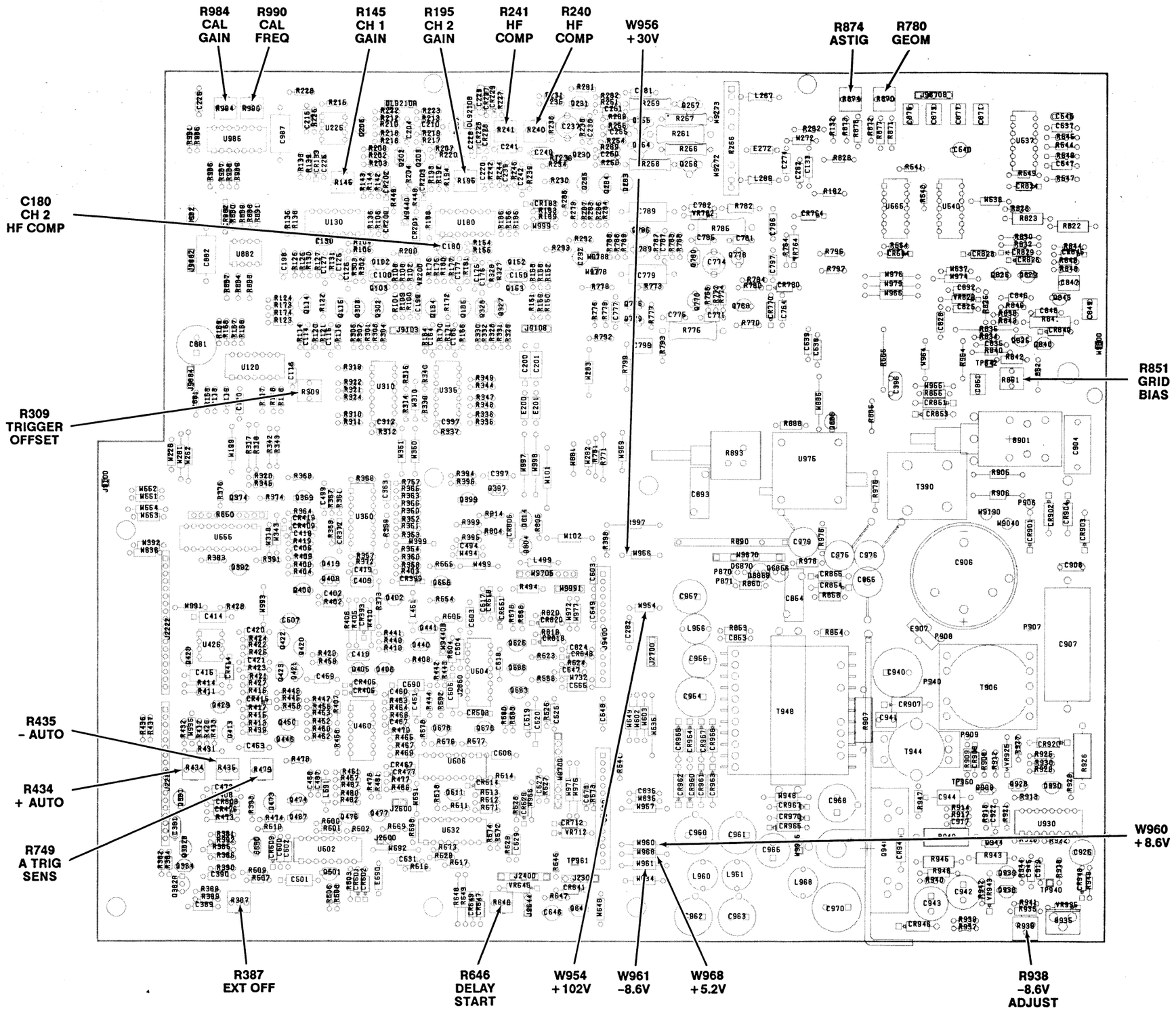


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Figure 9-14. A1—Main board component view adjustment locations.

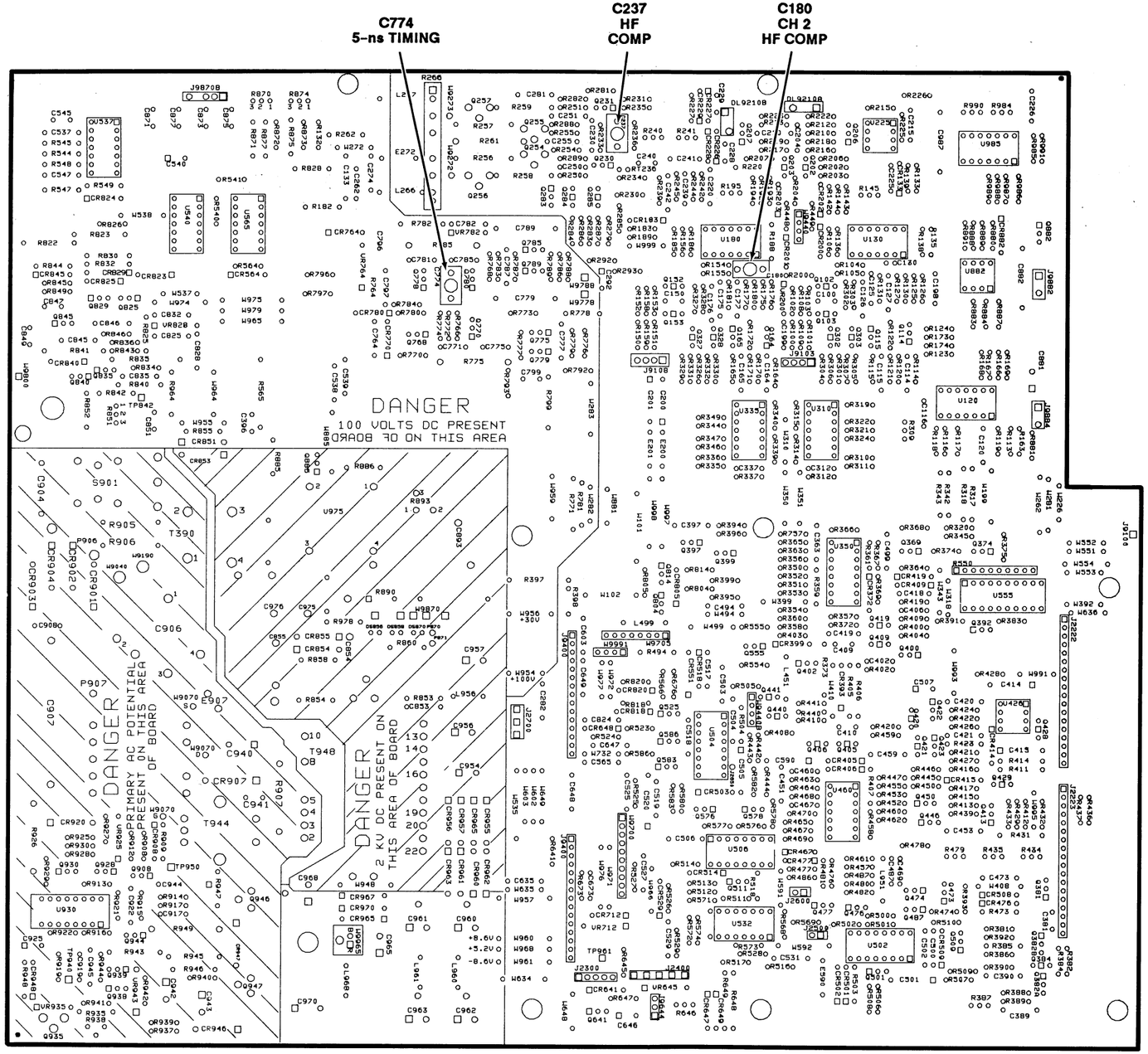

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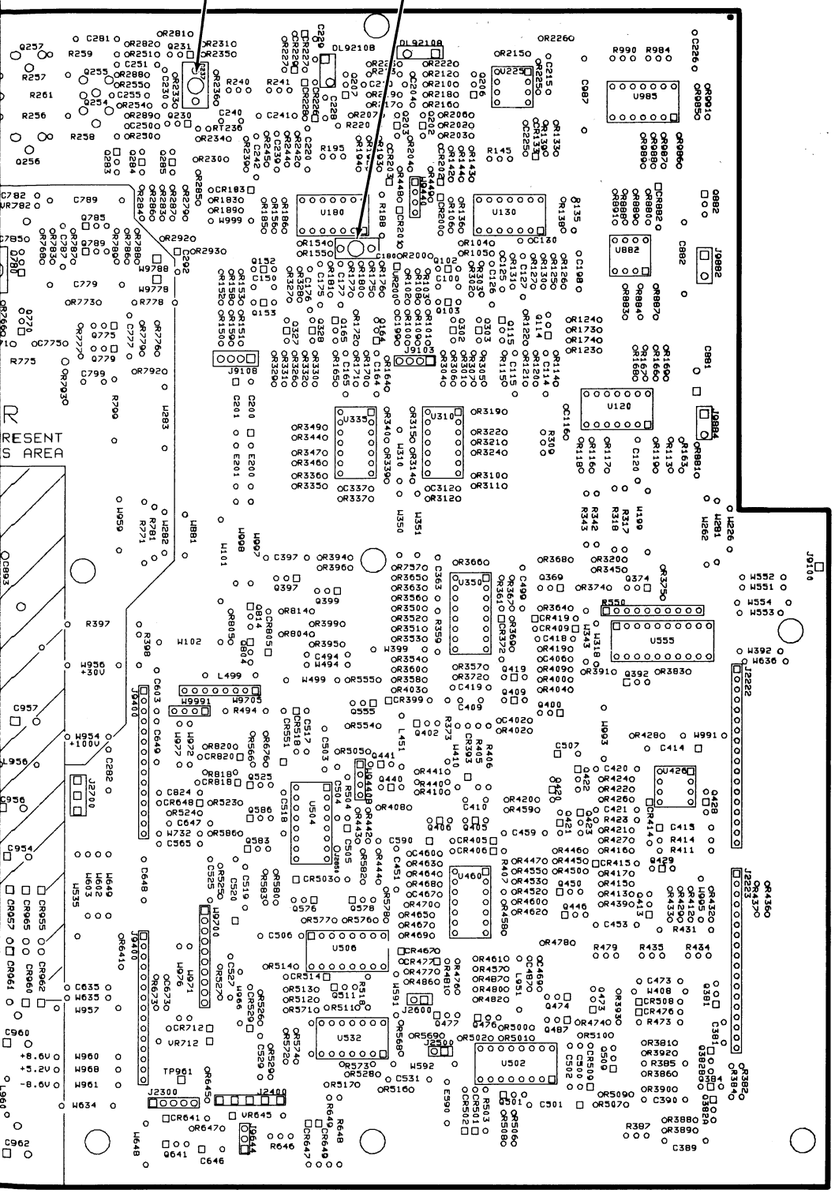
Figure 9-15. Main board circuit view adjustment locations.



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e 9-15. Main board circuit view adjustment locations.

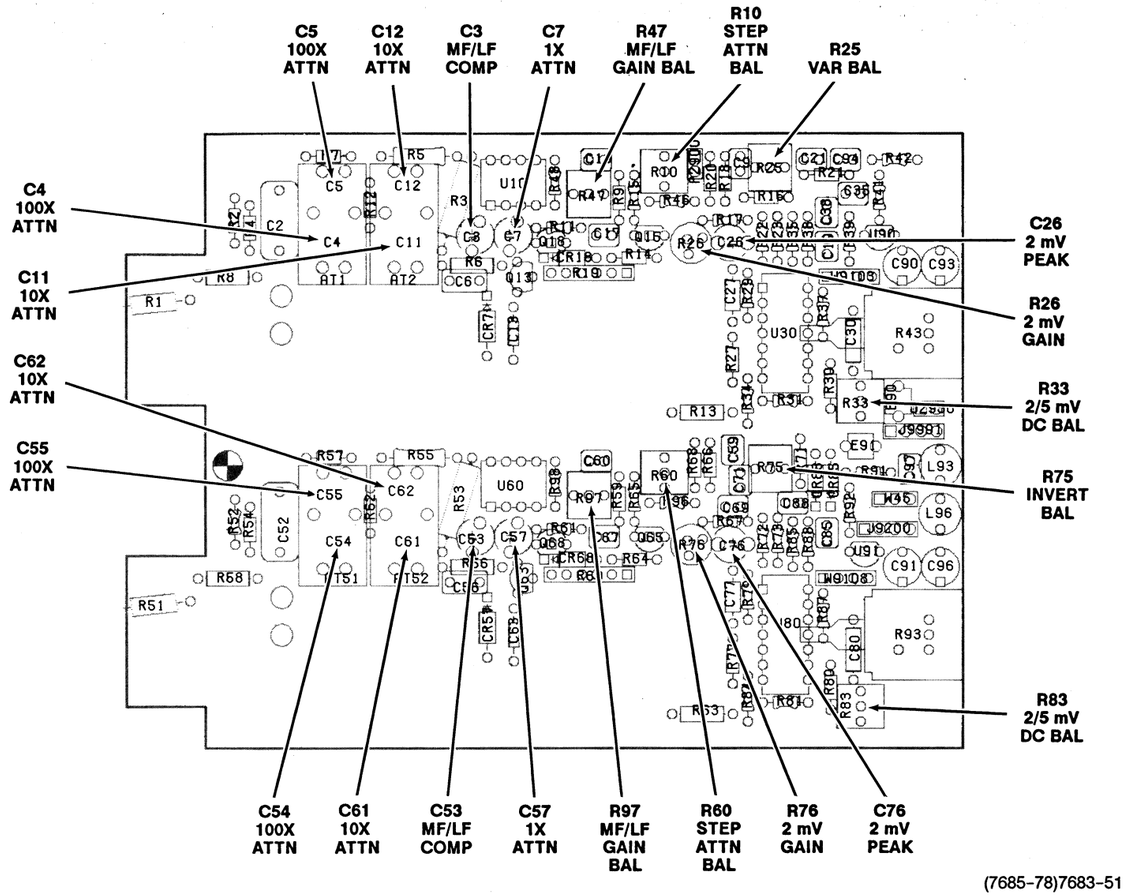

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Figure 9-16. A2—Attenuator board adjustment locations.

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	ON (button in)
A INTENSITY	Midrange
FOCUS	Midrange
Vertical POSITION	Midrange
Vertical MODE	CH 1
CH 1 VOLTS/DIV	0.1 V
CH 1 VOLTS/DIV Variable	CAL detent
Channel 1 Input Coupling	GND
Horizontal POSITION	Midrange
Horizontal MODE	A
A SEC/DIV	0.1 ms
A SEC/DIV Variable	CAL detent
X10 Magnifier	Off (knob in)
A TRIGGER Mode	P-P AUTO
A & B SOURCE	VERT MODE
A COUPL	NORM

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

SUPPLY	TEST POINT	TOLERANCE
-8.2 V	W961	-8.56 V to -8.64 V
+5.2 V	W968	5.04 V to 5.35 V
+8.6 V	W960	8.43 V to 8.77 V
+30 V	W956	+29.1 V to 30.9 V
+102 V	W954	+99 V to 105 V

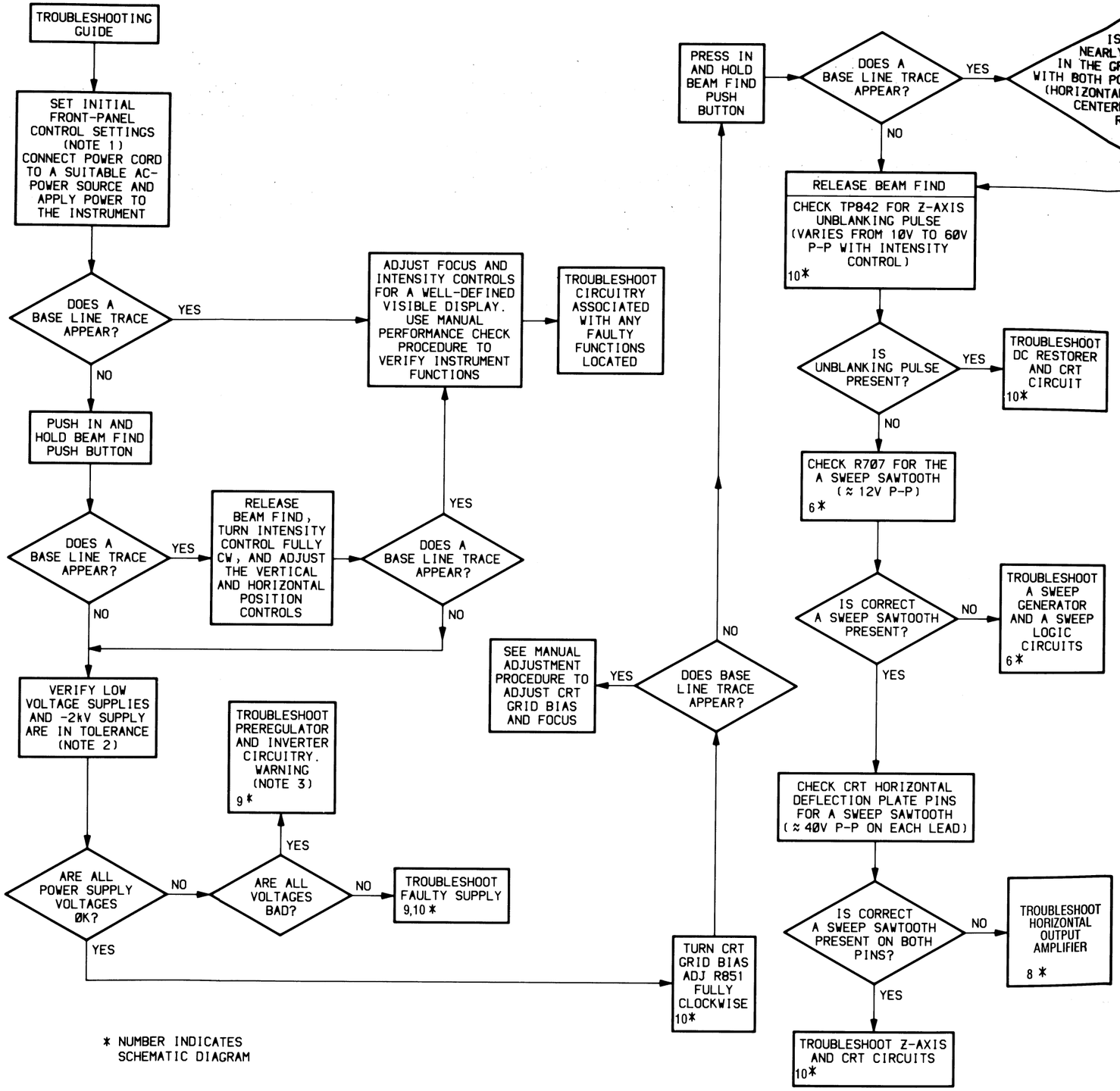
NOTE

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 lease -3kV, then turn the oscilloscope power back on to take the reading. After obtaining the reading, turn off the oscilloscope power to disconnect the test equipment connections, and replace the crt socket cover.

Verify the -2kV supply at pin 2 of the crt socket. The voltage should be between -1900 and -2100V.

3. ### WARNING

The preregulator and inverter circuits have a floating common reference with respect to chassis ground. Ac-source potential is present on the common reference points. Connect the instrument to the ac-power source through an isolation transformer to prevent the possibility of personal injury or equipment damage when troubleshooting these circuits.



ROUBLESHOOTING GUIDE

SET INITIAL FRONT-PANEL NTROL SETTINGS (NOTE 1) NECT POWER CORD A SUITABLE AC- WER SOURCE AND PPLY POWER TO HE INSTRUMENT

DOES A SE LINE TRACE APPEAR?

YES

ADJUST FOCUS AND INTENSITY CONTROLS FOR A WELL-DEFINED VISIBLE DISPLAY. USE MANUAL PERFORMANCE CHECK PROCEDURE TO VERIFY INSTRUMENT FUNCTIONS

TROUBLESHOOT CIRCUITRY ASSOCIATED WITH ANY FAULTY FUNCTIONS LOCATED

NO

PUSH IN AND OLD BEAM FIND PUSH BUTTON

DOES A SE LINE TRACE APPEAR?

YES

RELEASE BEAM FIND, TURN INTENSITY CONTROL FULLY CW, AND ADJUST THE VERTICAL AND HORIZONTAL POSITION CONTROLS

DOES A BASE LINE TRACE APPEAR?

YES

NO

NO

VERIFY LOW LTAGE SUPPLIES D -2kV SUPPLY E IN TOLERANCE (NOTE 2)

TROUBLESHOOT PREREGULATOR AND INVERTER CIRCUITRY. WARNING (NOTE 3) 9*

YES

ARE ALL POWER SUPPLY VOLTAGES ØK?

NO

ARE ALL VOLTAGES BAD?

NO

TROUBLESHOOT FAULTY SUPPLY 9,10*

YES

TURN CRT GRID BIAS ADJ R851 FULLY CLOCKWISE 10*

PRESS IN AND HOLD BEAM FIND PUSH BUTTON

DOES A BASE LINE TRACE APPEAR?

YES

IS TRACE NEARLY CENTERED IN THE GRATICULE AREA WITH BOTH POSITION CONTROLS (HORIZONTAL AND VERTICAL) CENTERED IN THEIR RANGE?

NO

YES

RELEASE BEAM FIND

CHECK TP842 FOR Z-AXIS UNBLANKING PULSE (VARIES FROM 10V TO 60V P-P WITH INTENSITY CONTROL) 10*

IS UNBLANKING PULSE PRESENT?

YES

TROUBLESHOOT DC RESTORER AND CRT CIRCUIT 10*

NO

CHECK R707 FOR THE A SWEEP SAWTOOTH (≈ 12V P-P) 6*

IS CORRECT A SWEEP SAWTOOTH PRESENT?

NO

TROUBLESHOOT A SWEEP GENERATOR AND A SWEEP LOGIC CIRCUITS 6*

YES

DOES BASE LINE TRACE APPEAR?

NO

YES

SEE MANUAL ADJUSTMENT PROCEDURE TO ADJUST CRT GRID BIAS AND FOCUS

CHECK CRT HORIZONTAL DEFLECTION PLATE PINS FOR A SWEEP SAWTOOTH (≈ 40V P-P ON EACH LEAD)

IS CORRECT A SWEEP SAWTOOTH PRESENT ON BOTH PINS?

NO

TROUBLESHOOT HORIZONTAL OUTPUT AMPLIFIER 8*

YES

TROUBLESHOOT Z-AXIS AND CRT CIRCUITS 10*

IS TRACE OFF CENTER HORIZONTALLY OR VERTICALLY?

VERTICALLY OFF CENTER

HORIZONTALLY OFF CENTER

TROUBLESHOOT HORIZONTAL OUTPUT AMPLIFIER 8* CIRCUITRY

RELEASE BEAM FIND BUTTON AND MOMENTARILY SHORT ACROSS DELAY LINE LEADS 3*

DOES TRACE COME TO NEAR CENTER OF GRATICULE AREA?

NO

TROUBLESHOOT VERTICAL OUTPUT AMPLIFIER 3*

YES

TROUBLESHOOT VERTICAL ATTENUATOR X1/X10 AMPL, VERTICAL PREAMPLIFIER, AND DELAY LINE DRIVER FOR SOURCE OF IMBALANCE 1,2,3*

* NUMBER INDICATES SCHEMATIC DIAGRAM

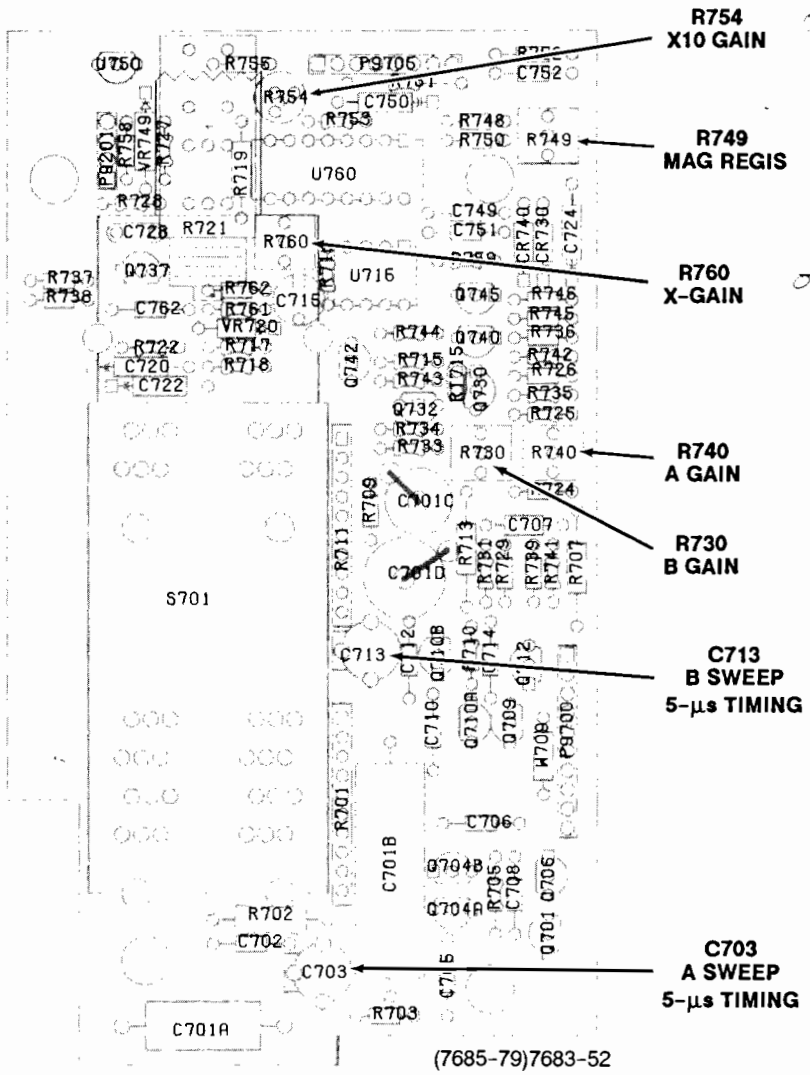
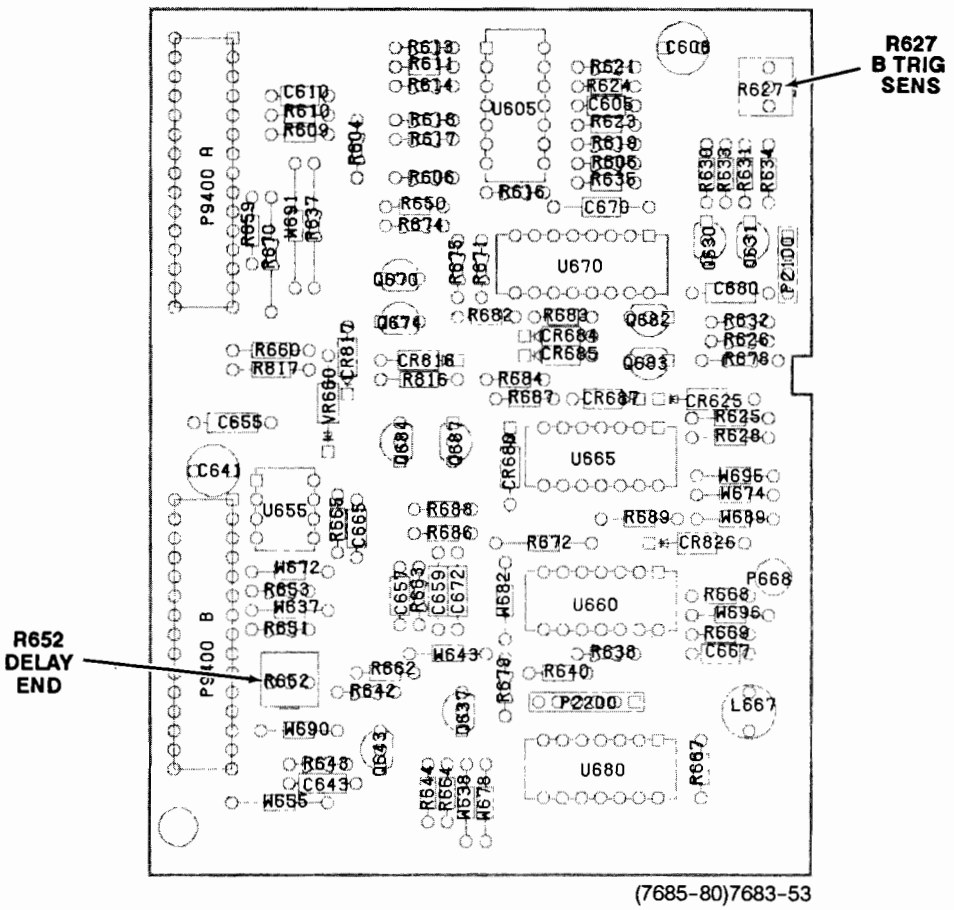


Figure 9–17. A4—Timing board adjustment locations.



(7685-80)7683-53

Figure 9-18. A5—Alternate Sweep board adjustment locations.

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

END ATTACHING PARTS

Detail Part of Assembly and/or Component
Attaching parts for Detail Part

END ATTACHING PARTS

Parts of Detail Part
Attaching parts for Parts of Detail Part

END ATTACHING PARTS

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.

Attaching parts must be purchased separately, unless otherwise specified.

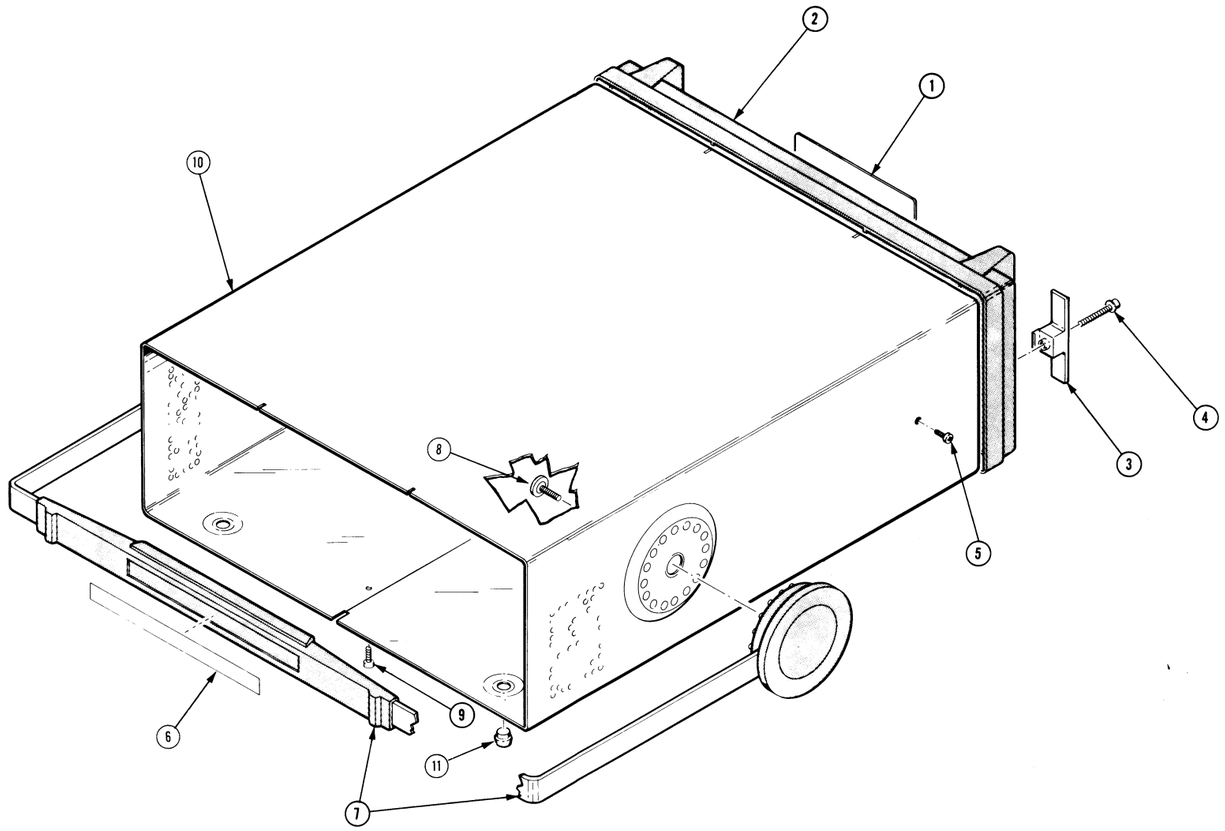
ABBREVIATIONS

Abbreviations conform to American National Standards Institute Y1.1

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
05129	KILO ENGINEERING CO	2118 D ST	LA VERNE CA 91750-5422
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
0J260	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200
12327	FREEWAY CORP	9301 ALLEN DR	CLEVELAND OH 44125-4632
13511	AMPHENOL CADRE DIV BUNKER RAMO CORP		LOS GATOS CA
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
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
S3109	FELLER	72 Veronica Ave Unit 4	Summerset NJ 08873
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
TK1285	GEROME MFG CO INC	PO BOX 737	NEWBURG OR 97132
TK1287	ENOCH MFG CO	14242 SE 82ND DR PO BOX 98	CLACKAMAS OR 97015
TK1319	MORELLIS Q & D PLASTICS	1812 16-TH AVE	FOREST GROVE OR 97116
TK1336	PARSONS MFG CORP	1055 OBRIEN	MENLO PARK CA 94025
TK1544	COMPUTER CONNECTIONS	30608 SAN ANTONIO ST	HAYWARD CA 94544
TK1570	HERD MFG	9227 CLINTON RD	CLEVELAND OH 44144
TK1935	ACCRA FAB INC	11007 NE 37TH CIRCLE	VANCOUVER WA 98682
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
-2	200-3153-06			1	COVER,REAR ASSY:W/LABELS	80009	200-3153-06
-3	343-1278-00			2	RTNR,POWER CORD:POLYCARBONATE GRAY (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-4	211-0712-00			2	SCR,ASSEM WSHR:6-32 X 1.25,PNH,STL,TORX (END ATTACHING PARTS)	01536	ORDER BY DESCR
-5	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL	80009	211-0722-00
-6	334-7801-00			1	MARKER,IDENT:MKD 2235A	80009	334-7801-00
-7	367-0289-00			1	HANDLE,CARRYING:13.855,SST (ATTACHING PARTS)	80009	367-0289-00
-8	212-0144-00			2	SCREW,TPG,TF:8-16 X 0.562 L,PLASTITE,SPCL HD (END ATTACHING PARTS)	93907	225-38131-012
-9	211-0325-00			1	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-10	390-0790-00			1	CABINET,SCOPE:	TK1935	ORDER BY DESCR
-11	348-0659-00			2	FOOT,CABINET:BLACK POLYURETHANE	TK2165	ORDER BY DESCR



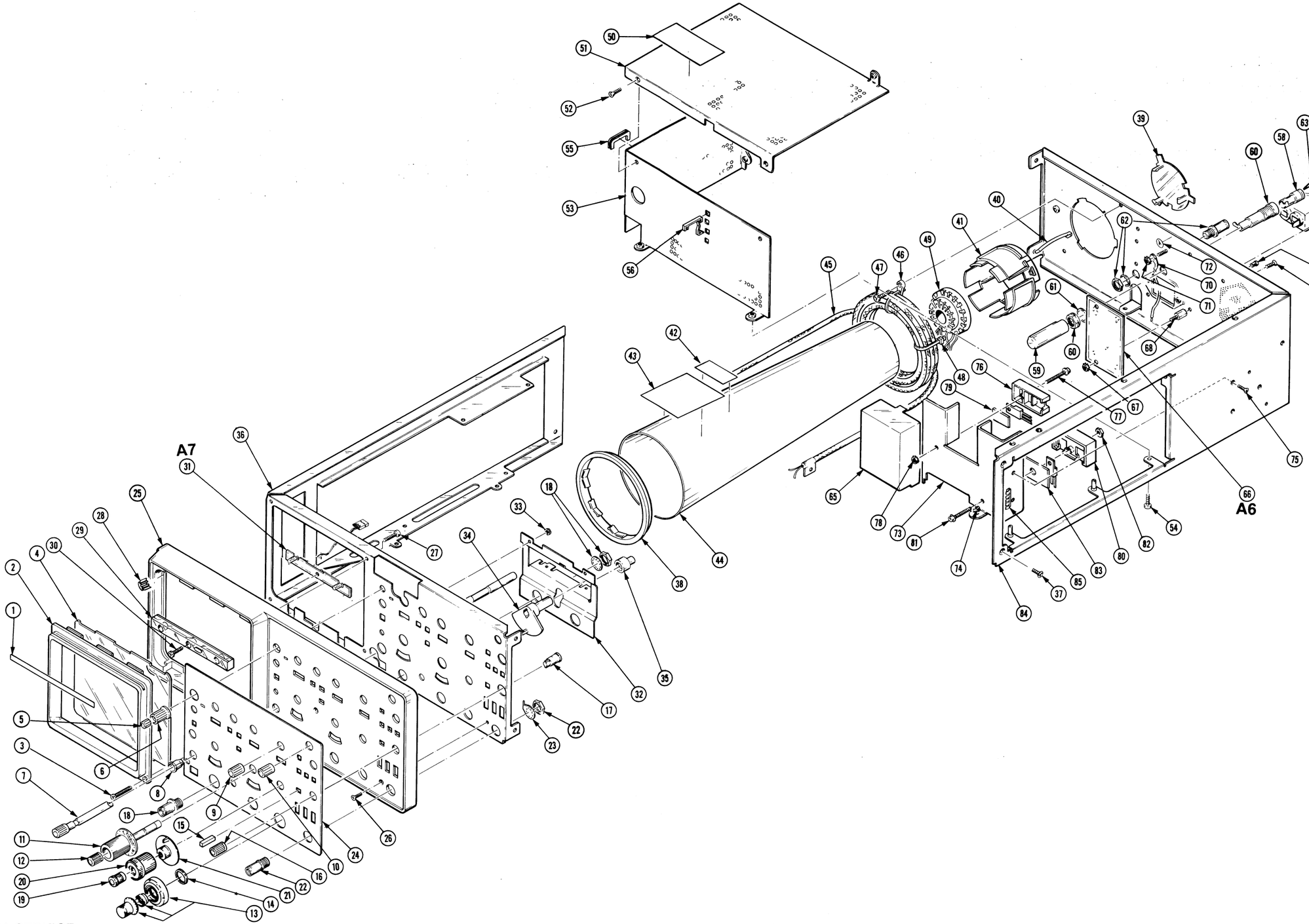


Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	334-7726-00			1	MARKER,IDENT:MKD BEZEL	80009	334-7726-00
-2	426-1765-02			1	FRAME,CRT:POLYCARBONATE,GRAY (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-3	211-0690-01			2	SCREW,MACHINE:6-32 X 0.875 PNH,SST (END ATTACHING PARTS)	86113	ORDER BY DESCR
-4	337-2775-00			1	SHLD,IMPLOSION:FILTER,BLUE 2211/2213/2215	80009	337-2775-00
-5	366-1391-04			1	KNOB:GRAY,0.3 OD X 0.14 ID X 0.32 H	TK2165	366-1391-04
-6	366-1879-01			1	KNOB:GRAY 0.5 OD X 0.531 H PLSTC	80009	366-1879-01
-7	384-1575-00			1	EXTENSION SHAFT:8.805 L,W/KNOB,PLASTIC	80009	384-1575-00
-8	358-0550-00			1	BUSHING,SHAFT:0.15 ID X 0.488 L,PLSTC	TK2165	ORDER BY DESCR
-9	366-1146-00			2	KNOB:GY,0.127 ID X 0.392 OD X 0.466 H	80009	366-1146-00
-10	366-1146-00			2	KNOB:GY,0.127 ID X 0.392 OD X 0.466 H	80009	366-1146-00
-11	366-2148-01			2	KNOB:GY,VOLTS/DIV,0.72 OD,0.79 HW/0.25 DIA SHAFT & SKIRT	80009	366-2148-01
-12	366-0575-00			2	KNOB:GRAY,CAL,0.127 ID X 0.392 OD X 0.4 H	TK2165	ORDER BY DESCR
-13	331-0328-00			1	DIAL,CONTROL:10 TURN,0.0 TO 9.99	05129	461-S-70
-14	210-0840-00			1	WASHER,FLAT:0.39 ID X 0.562 OD X 0.02,STL	86928	ORDER BY DESCR
-15	366-0573-00			9	PUSH BUTTON:IVORY GY,0.186 SQ X 0.48 H	TK2165	ORDER BY DESCR
-16	366-2049-01			6	KNOB:GY,0.172 ID X 0.41 OD X 0.496 H W/BAR	80009	366-2049-01
-17	377-0512-03			6	INSERT,KNOB:0.128 ID X 0.37 OD X 0.67 L,XL	80009	377-0512-03
-18	131-0126-00			2	CONN,RCPT,ELEC:BNC,FEMALE	24931	28JR205-2
-19	366-0576-00			1	KNOB:MED GRAY,CAL,0.083 ID X 0.45 OD X 0.456 H	TK2165	ORDER BY DESCR
-20	366-1840-04			1	KNOB:GY,TIME/DIV,0.127 ID X 0.855 OD X 0.844 H	80009	366-1840-04
-21	366-1850-00			1	KNOB:CLEAR,0.252 ID X 1.2 OD X 0.383 H	80009	366-1850-00
-22	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
-23	210-0255-00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	12327	ORDER BY DESCR
-24	333-3780-00			1	PANEL,FRONT:	07416	ORDER BY DESCR
-25	386-4850-04			1	SUBPANEL,FRONT: (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-26	213-0881-00			3	SCREW,TPG,TR:6-32 X 0.25 TYPE TT,FILH,STL	83385	ORDER BY DESCR
-27	213-0882-00			2	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-28	348-0660-00			4	CUSHION,CRT:POLYURETHANE	80009	348-0660-00
-29	378-0877-02			1	REFLECTOR,LIGHT:PLASTIC (ATTACHING PARTS)	80009	378-0877-02
-30	213-0914-00			1	SCREW,TPG,TR:6-32 X 0.75,FLH,100 DEG,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-31	----- -----			1	SCALE ILLUM BOARD ASSY(SEE A7 REPL)		
-32	407-3217-02			1	BRACKET,GROUND:ALUMINUM (ATTACHING PARTS)	TK1570	ORDER BY DESCR
-33	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL END ATTACHING PARTS)	78189	211-041800-00
-34	214-3375-01			2	LEVER,SWITCH:AC/DC,PLASTIC	TK2165	ORDER BY DESCR
-35	358-0728-00			1	BUSHING,BD MTG:ALUMINUM	TK1287	ORDER BY DESCR
-36	441-1571-00			1	CHASSIS,SCOPE:FRONT,L FRAME (ATTACHING PARTS)	TK1285	ORDER BY DESCR
-37	213-0881-00			4	SCREW,TPG,TR:6-32 X 0.25 TYPE TT,FILH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-38	386-4443-00			1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386-4443-00
-39	200-2519-00			1	CAP,CRT SOCKET:NATURAL LEXAN	80009	200-2519-00
-40	214-1061-06			1	SPRING,GROUND:CRT SHIELD	80009	214-1061-06
-41	426-1766-00			1	MOUNT,RESILIENT:CRT,REAR	80009	426-1766-00
-42	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	07416	ORDER BY DESCR
-43	334-1951-00			1	MARKER,IDENT:MKD WARNING,CRT VOLTAGES	22670	ORDER BY DESCR
-44	337-2774-00			1	SHIELD,ELEC:CRT,STEEL	23740	C-2059
-45	----- -----			1	DELAY LINE,ELEC:(SEE DL9210 CHASSIS REPL)		
-46	346-0121-00			2	STRAP,TIEDOWN,E:6.125 L,NYLON (ATTACHING PARTS)	06383	PLC1.5I-S8
-47	213-0882-00			2	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
-48	346-0128-00			1	STRAP,TIEDOWN,E:8.0 L X 0.1 W,NYLON	06383	PLT2M
-49	136-1075-00			1	SKT,PL-IN ELEK:CRT SOCKET ASSY	TK1544	ORDER BY DESCR
-50	334-4251-00			1	MARKER,IDENT:MKD CAUTION	07416	ORDER BY DESCR
-51	337-2772-04			1	SHIELD,ELEC:POWER SUPPLY,TOP,ALUMINUM,MM & NSO (ATTACHING PARTS)	80009	337-2772-04

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-52	211-0379-00			5	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9 (END ATTACHING PARTS)	80009	211-0379-00
-53	337-2772-03			1	SHIELD,ELEC:POWER SUPPLY,SIDE,ALUMINUM,MM (ATTACHING PARTS)	80009	337-2772-03
-54	211-0305-00			1	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,CD PL (END ATTACHING PARTS)	01536	ORDER BY DESCR
-55	348-0555-00			1	GROMMET,PLASTIC:SIL GY,U SHAPE,0.52 ID	80009	348-0555-00
-56	344-0334-01			1	CLIP,CKT BD:PLASTIC,GRAY	TK2165	ORDER BY DESCR
-57	134-0158-00			2	BUTTON,PLUG:0.187 DIA,NYLON	02768	207-080501-00
-58	200-2264-00			1	CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
-59	200-1388-03			1	COVER,FUSE LEAD:POLYURETHANE	80009	200-1388-03
-60	204-0833-00			1	BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	TK0861	031 1653 (FEU)
-61	210-1039-00			1	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST	24931	ORDER BY DESCR
-62	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
-63	----- -----			1	FILTER,RFI:(SEE FL9001 CHASSIS REPL) (ATTACHING PARTS)		
-64	211-0379-00			2	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9 (END ATTACHING PARTS)	80009	211-0379-00
-65	200-2845-00			1	COVER,CKT BOARD:LINE FILTER	TK2165	ORDER BY DESCR
-66	----- -----			1	CKT BOARD ASSY:EMI FILTER(SEE A6 REPL) (ATTACHING PARTS)		
-67	210-0586-00			2	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-68	129-0999-00			2	SPACER,POST:0.485 L,4-40 INT/EXT,STL,0.25 HEX	TK0858	ORDER BY DESCR
-69	211-0379-00			2	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9 (END ATTACHING PARTS)	80009	211-0379-00
-70	195-3990-00			1	LEAD,ELECTRICAL:18 AWG,4.5 L,5-4 (ATTACHING PARTS)	80009	195-3990-00
-71	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL CD PL (END ATTACHING PARTS)	78189	511-061800-00
-72	334-3379-06			1	MARKER,IDENT:MKD GROUND SYMBOL	80009	334-3379-06
-73	407-3673-00			1	BRACKET,HEAT SK:ALUMINUM (ATTACHING PARTS)	80009	407-3673-00
-74	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL	78189	211-041800-00
-75	211-0379-00			2	SCREW,MACHINE:4-40 X 0.312,FLH,CD PL,T-9 (END ATTACHING PARTS)	80009	211-0379-00
-76	343-1025-00			1	RETAINER,XSTR: (ATTACHING PARTS)	TK1154	ORDER BY DESCR
-77	211-0302-00			1	SCR,ASSEM WSHR:4-40 X 0.75,PNH,STL,TORX DR	01536	ORDER BY DESCR
-78	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-79	342-0582-00			1	INSULATOR,PLATE:TRANSISTOR,CERAMIC	80009	342-0582-00
-80	343-0969-00			1	RETAINER,XSTR: (ATTACHING PARTS)	80009	343-0969-00
-81	211-0691-00			1	SCREW,MACHINE:6-32 X 0.625,PNH,STL	TK0858	ORDER BY DESCR
-82	210-0408-00			1	NUT,PLAIN,HEX:6-32 X 0.312,BRS CD PL (END ATTACHING PARTS)	73743	3040-402
-83	342-0555-00			2	INSULATOR,PLATE:HEAT SINK,ALUMINA	80009	342-0555-00
-84	441-1536-03			1	CHASSIS,SCOPE:REAR,L FRAME	TK1285	ORDER BY DESCR
-85	344-0367-01			3	CLIP,GROUND:CU-BE	80009	344-0367-01

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	337-2773-02			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	80009	366-1480-03
-5	384-1576-01			1	EXTENSION SHAFT:12.544 L,PLASTIC	80009	384-1576-01
-6	----- -----			1	SWITCH,PUSH:4A 250VAC B (SEE A1S901 REPL)		
-7	377-0512-03			6	INSERT,KNOB:0.128 ID X 0.37 OD X 0.67 L,XL	80009	377-0512-03
-8	----- -----			1	CKT BOARD ASSY:FRONT PANEL(SEE A3 REPL) (ATTACHING PARTS)		
-9	211-0325-00			4	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
-10	----- -----			1	CKT BOARD ASSY:ALTERNATE SWEEP(SEE A5 REPL)		
-11	----- -----			1	CKT BOARD ASSY:MAIN(SEE A1 REPL)		
-12	337-3201-04			1	SHIELD,ELEC:TOP ATTEN (ATTACHING PARTS)	TK1285	ORDER BY DESCR
-13	211-0325-00			4	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-14	211-0326-00			2	SCREW,MACHINE:4-40 X 1.25,PNH,STL (END ATTACHING PARTS)	83486	ORDER BY DESCR
-15	----- -----			1	CKT BOARD ASSY:ATTENUATOR(SEE A2 REPL) (ATTACHING PARTS)		
-16	211-0305-00			1	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,CD PL	01536	ORDER BY DESCR
-17	361-1166-00			1	SPACER,SLEEVE:0.228 L X 0.162 ID,BRS	0J260	ORDER BY DESCR
-18	211-0325-00			1	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-19	129-0988-00			1	SPACER,POST:0.966 L,4-40 EA END,AL,0.188 HEX (END ATTACHING PARTS) CKT BOARD ASSY INCLUDES;	TK0858	ORDER BY DESCR
-20	384-1056-00			2	.EXTENSION SHAFT:6.58 L X 0.123 OD,EPOX GL	TK2278	ORDER BY DESCR
-21	401-0370-01			2	.BEARING,CAM SW:END,0.6 DIA (ATTACHING PARTS)	80009	401-0370-01
-22	211-0343-00			2	.SCREW,MACHINE:4-40 X 0.25,TRUSS HD,STL	TK0858	ORDER BY DESCR
-23	361-1300-00			2	.SPACER,BEARING:0.115 ID X 0.2 OD,BRASS	TK2278	ORDER BY DESCR
-24	210-0406-00			8	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL (END ATTACHING PARTS)	73743	12161-50
-25	214-1126-02			4	.SPRING,FLAT:0.7 X 0.125,CU BE RED CLR	80009	214-1126-02
-26	214-1752-00			8	.ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-27	105-0934-01			2	.ACTUATOR,CAM SW:AC-GND-DC	80009	105-0934-01
-28	401-0369-00			2	.BEARING,CAM SW:CENTER,0.6 DIA (ATTACHING PARTS)	80009	401-0369-00
-29	211-0325-00			4	.SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-30	210-0406-00			2	.NUT,PLAIN,HEX:4-40 X 0.188,BRS CD PL (END ATTACHING PARTS)	73743	12161-50
-31	105-0935-02			2	.ATTEN CAM SW:ATTENUATOR VOLTS PER DIVISION	80009	105-0935-02
-32	401-0370-00			2	.BEARING,CAM SW:END,0.6 DIA	80009	401-0370-00
-33	214-1126-01			4	.SPRING,FLAT:0.7 X 0.125,CU BE GRN CLR	80009	214-1126-01
-34	214-1752-00			8	.ROLLER,DETENT:0.125 OD X 0.16,SST	80009	214-1752-00
-35	----- -----			1	.VAR RES 10K C (SEE A02R19/R93)		
-36	343-1020-00			2	.RETAINER,CONT:ABS GRAY (ATTACHING PARTS)	TK2165	ORDER BY DESCR
-37	211-0325-00			4	.SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9	01536	ORDER BY DESCR
-38	361-1218-00			2	.SPACER,SLEEVE:0.738 L X 0.13 ID,BRS (END ATTACHING PARTS)	TK2278	ORDER BY DESCR
-39	131-1758-11			2	.CONT ASSY,ELEC:8 CONTACTS	TK2165	ORDER BY DESCR
-40	131-1758-12			2	.CONT ASSY,ELEC:8 CONTACTS	TK2165	ORDER BY DESCR
-41	----- -----			1	CKT BOARD ASSY:TIMING(SEE A4 REPL) (ATTACHING PARTS)		
-42	211-0325-00			3	SCR,ASSEM WSHR:4-40 X 0.25,PNH,STL,TORX T9 (END ATTACHING PARTS)	01536	ORDER BY DESCR
-43	337-3291-01			1	SHIELD,ELEC:BOTTOM,2200 (ATTACHING PARTS)	TK1285	ORDER BY DESCR
-44	210-0586-00			1	NUT,PL,ASSEM WA:4-40 X 0.25,STL CD PL (END ATTACHING PARTS)	78189	211-041800-00
-45	129-0906-00			2	SPACER,POST:0.685 L,4-40 INT/EXT,AL,0.25 HEX	TK0858	ORDER BY DESCR
-46	129-0999-00			1	SPACER,POST:0.485 L,4-40 INT/EXT,STL,0.25 HEX	TK0858	ORDER BY DESCR

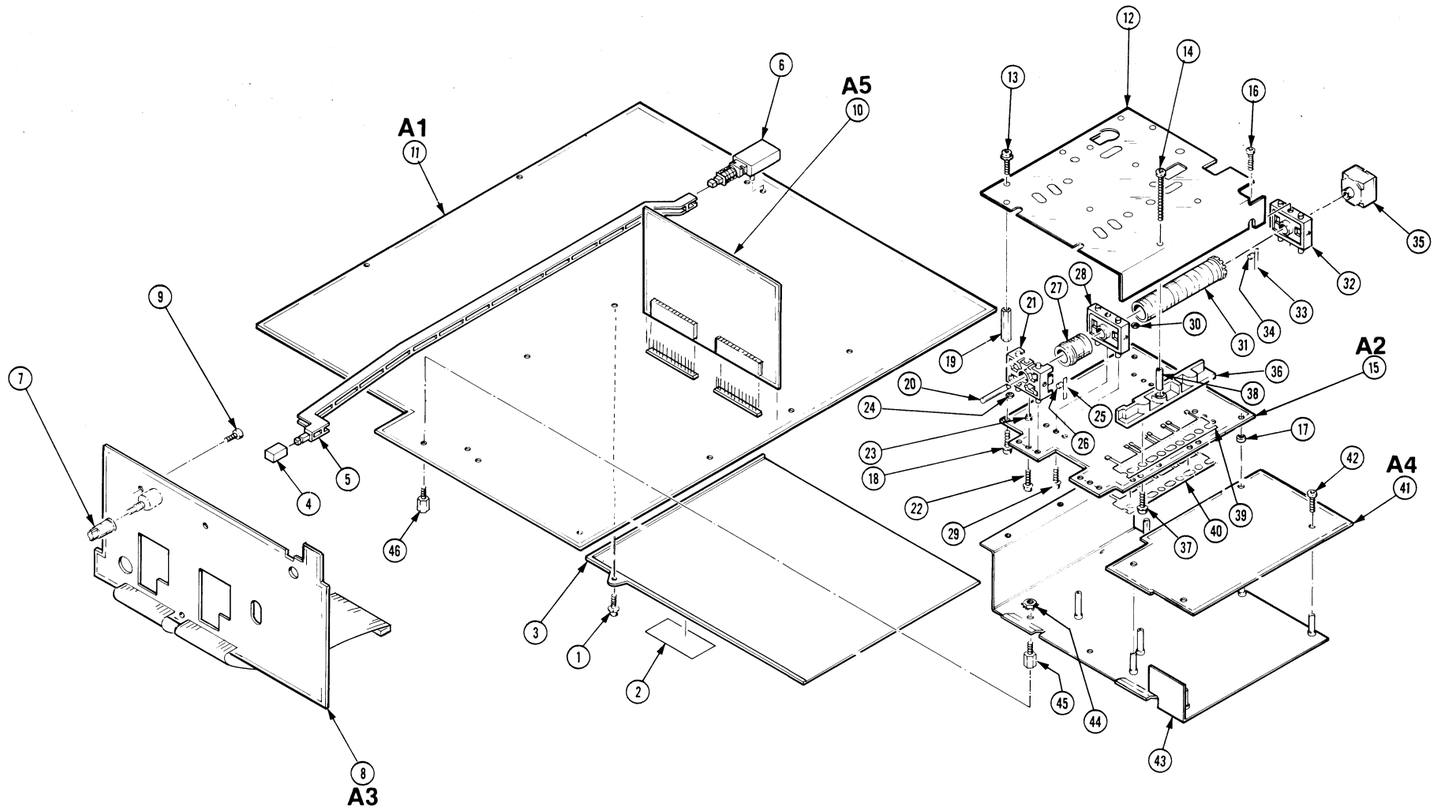
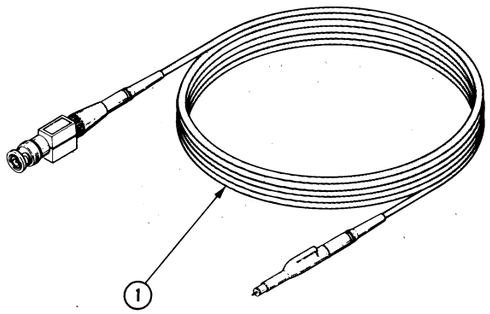
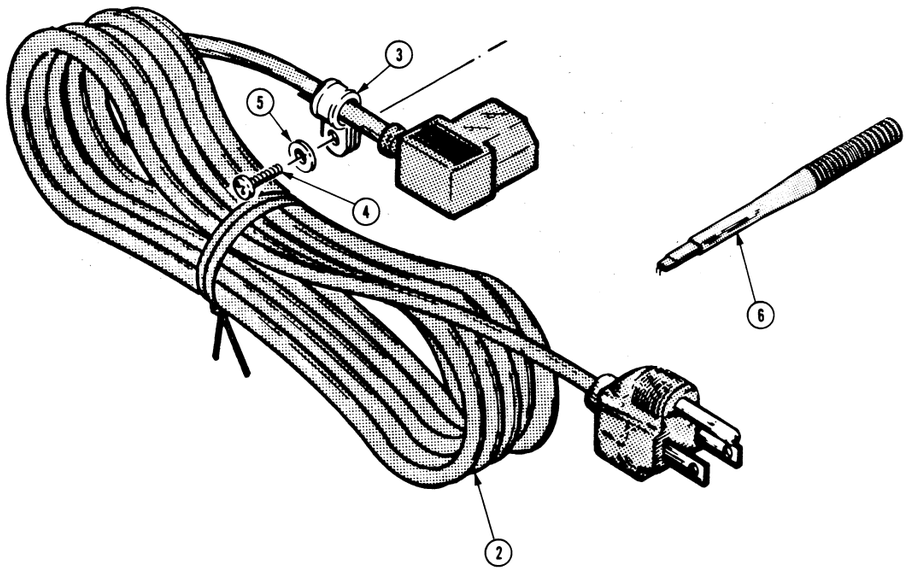
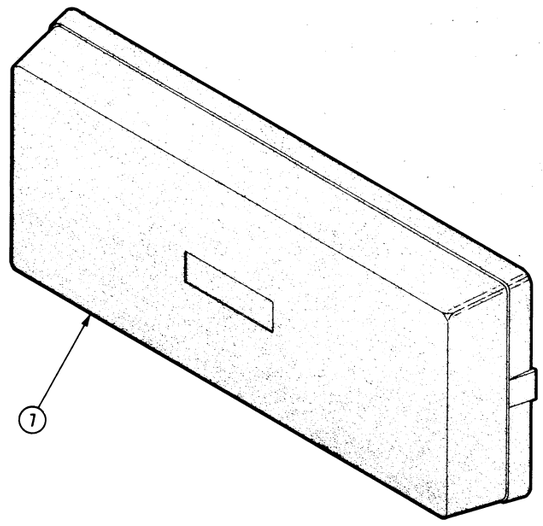


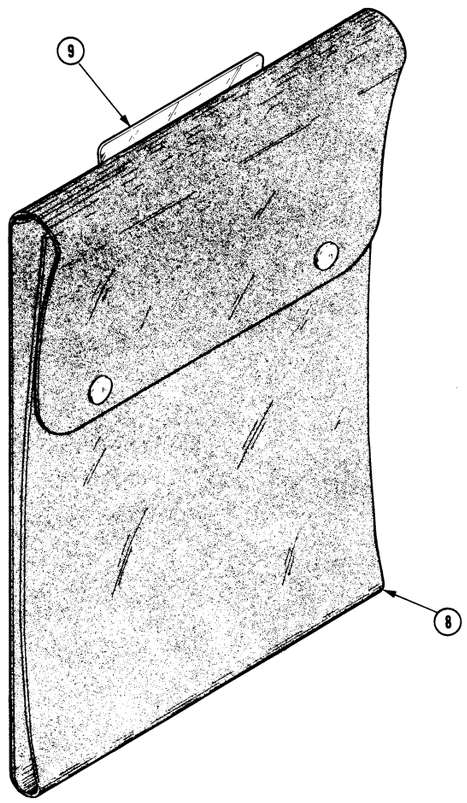
FIG. 3 ATTENUATOR ASSY. & BOTTOM

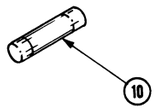
Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4-							
					STANDARD ACCESSORIES		
-1	015-0527-01			2	ACCESSORY PKG:TWO P6109 OPT 01 PROBES	80009	015-0527-01
	070-7683-00			1	MANUAL,TECH:INSTRUCTION,2235A	80009	070-7683-00
	159-0041-00			1	FUSE,CARTRIDGE:3AG,1.25A,250V,20SEC	71400	MSL 1 1/4
-2	161-0230-01			1	CABLE ASSY,PWR,:3,18 AWG,92.0 L	80009	161-0230-01
-3	343-0003-00			1	CLAMP,LOOP:0.25 ID,PLASTIC	06915	E4 CLEAR ROUND
-4	213-0882-00			1	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	83385	ORDER BY DESCR
-5	210-0803-00			1	WASHER,FLAT:0.15 ID X 0.375 OD X 0.032,STL	12327	ORDER BY DESCR
					OPTIONAL ACCESSORIES		
	----- -----			1	ACCESSORY PKG:TWO P6109 OPT 01 PROBES		
-6	013-0191-00			1	TIP,PROBE:W/ACTUATOR	80009	013-0191-00
	020-0672-02			1	ACCESSORY KIT:	80009	020-0672-02
-7	200-2520-00			1	.COVER,SCOPE:FRONT,ABS	TK2165	ORDER BY DESCR
	016-0677-02			1	.POUCH,ACCESSORY:W/PLATE	TK0174	016-0677-02
-8	016-0535-01			1	..POUCH,ACCESSORY:EXPANDED POLYESTER	80009	016-0535-01
-9	386-4674-00			1	..PLATE,MOUNTING:ACCESSORY POUCH,ALUMINUM	0J260	ORDER BY DESCR
-10	159-0041-00			1	..FUSE,CARTRIDGE:3AG,1.25A,250V,20SEC	71400	MSL 1 1/4
	016-1061-00			1	PAPER,PRINTED:A-SIZE,COATED,210 X 297 (SEE MANUAL 070-4186-XX)	80009	016-1061-00
	346-0199-00			1	STRAP,CARRYING:MKD TEKTRONIX	80009	346-0199-00
	020-0859-00			1	COMPONENT KIT:EUROPEAN	80009	020-0859-00
	343-0170-00			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
-11	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			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
-12	161-0104-07			1	.CABLE ASSY,PWR,:3 X 0.75MM SQ,240V,98.0 L	80009	161-0104-07
	020-0861-00			1	COMPONENT KIT:AUSTRALIAN	80009	020-0861-00
	343-0170-00			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
-13	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			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
-14	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			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
-15	161-0167-00			1	.CABLE ASSY,PWR,:3.0 X 0.75,6A,240V,2.5M L	80009	161-0167-00
	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
	390-0790-15			1	CABINET ASSY:W/BUMPER & HANDLE (OPTION 33 ONLY) CABINET ASSY INCLUDES:	TK1935	ORDER BY DESCR
	200-2538-33			1	.COVER ASSEMBLY:REAR,W/RUBBER BUMPER	80009	200-2538-33
	212-0144-00			2	.SCREW,TPG,TF:8-16 X 0.562 L,PLASTITE,SPCL .HD	93907	225-38131-012
	367-0289-00			1	.HANDLE,CARRYING:13.855,SST	80009	367-0289-00
	390-0790-13			1	.CABINET,SCOPE:W/BUMPER	TK1319	ORDER BY DESCR

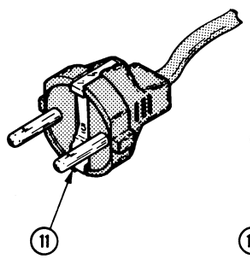


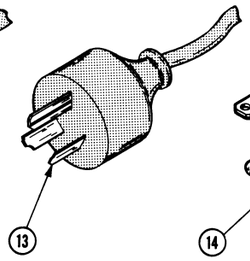


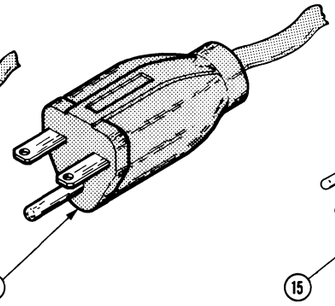


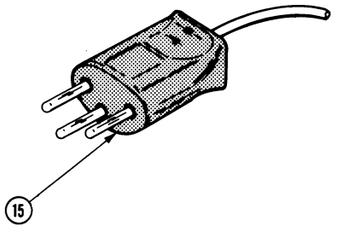












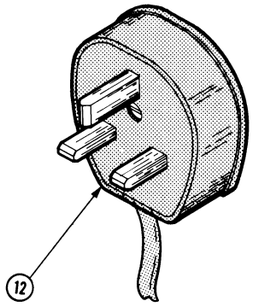


FIG. 4 ACCESSORIES

MANUAL CHANGE INFORMATION

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

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

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

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MANUAL CHANGE INFORMATION

Date: 12-1-90 Change Reference: C3/1190 (REV)

Product: 2235A INSTRUCTION Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE ALL SERIAL NUMBERS

Page 4-6 Step 2. Check Position Range

Replace Step 2 with the following procedure:

2. Check Position Range

a. Disconnect the calibration generator from the CH 2 input connector and connect the leveled sine-wave generator output via a 50-Ω cable and a 50-Ω termination to the CH 2 input connector.

b. Set:

VOLTS/DIV (both)	0.1 V
Input Coupling (both)	AC

c. Set the generator to produce a 50-kHz, 2-division display.

d. Set the CH 2 VOLTS/DIV switch to 10 mV.

e. Rotate the CH 2 POSITION control fully clockwise.

f. CHECK—That the bottom of the waveform is positioned at least 1 division above the center horizontal graticule line.

g. Rotate the CH 2 POSITION control fully counterclockwise.

h. CHECK—That the top of the waveform is positioned at least 1 division below the center horizontal graticule line.

i. Move the cable from the CH 2 input connector to the CH 1 input connector and set the Vertical MODE switch to CH 1.

j. Repeat parts d through h using the Channel 1 controls.

NOTE

Before continuing to Step 3, Check Trigger View Gain, disconnect the leveled sine-wave generator from the CH 1 input connector and connect the calibration generator to the CH 1 input connector via a 50-Ω cable and a 50-Ω termination.

Set the generator to produce a 0.2-V standard amplitude signal.

Page 4-6 Step 3. Check Trigger View Gain

Replace part k of Step 3 with the following:

k. Set the generator to produce a 2-V signal.

Page 4-10 Step 3. Check Delay Time Dial Range and Accuracy

Replace part q of Step 3 with the following:

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

Page 4-11 Step 7. Check X-Y Phasing

Replace part c of Step 7 with the following:

c. Adjust the low-frequency generator for an 8-division horizontal display at 150 kHz.

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MANUAL CHANGE INFORMATION

Date: 4-9-91 Change Reference: M70911

Product: 2235A SERVICE Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B012088

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A6RT901	307-1551-00	RES, THERMAL, 20 OHM, 10%, NTC

DIAGRAM CHANGES

DIAGRAM 9 POWER INPUT, PREREGULATOR, & INVERTER

Change the value of resistor RT901 (location 2B) to 20 Ω.

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MANUAL CHANGE INFORMATION

Date: 3-28-90 Change Reference: M71722

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B011671

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A5C672	281-0785-00	CAP,FXD,CER DI: 68PF,10%,100V,MI

DIAGRAM CHANGES

DIAGRAM  B TIMING & ALTERNATE B SWEEP

Change the value of capacitor C672 (location 4E) to 68 pF.

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MANUAL CHANGE INFORMATION

Date: 4-3-90 Change Reference: M71825

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B011890

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A2R29	322-3086-00	RES,FXD,FILM: 76.8 OHM,1%,0.2W
A2R79	322-3086-00	RES,FXD,FILM: 76.8 OHM,1%,0.2W

DIAGRAM CHANGES

DIAGRAM 1 CH1 & CH2 ATTENUATORS

Change the value of resistor R29 (location 2F) to 76.8 Ω.

Change the value of resistor R79 (location 4F) to 76.8 Ω.

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MANUAL CHANGE INFORMATION

Date: 3-28-90 Change Reference: M71843

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B011803

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A3R110	322-3289-00	RES,FXD,FILM: 10K OHM,1%,0.2W
A3R111	322-3289-00	RES,FXD,FILM: 10K OHM,1%,0.2W
A3R160	322-3289-00	RES,FXD,FILM: 10K OHM,1%,0.2W
A3R161	322-3289-00	RES,FXD,FILM: 10K OHM,1%,0.2W

DIAGRAM CHANGES

DIAGRAM 2 VERTICAL PREAMPS & SWITCHING

Change the value of resistor R110 (location 2C) to 10K Ω.

Change the value of resistor R111 (location 1C) to 10K Ω.

Change the value of resistor R160 (location 3C) to 10K Ω.

Change the value of resistor R161 (location 3C) to 10K Ω.

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MANUAL CHANGE INFORMATION

Date: 3-28-90 Change Reference: M71944

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B011625

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

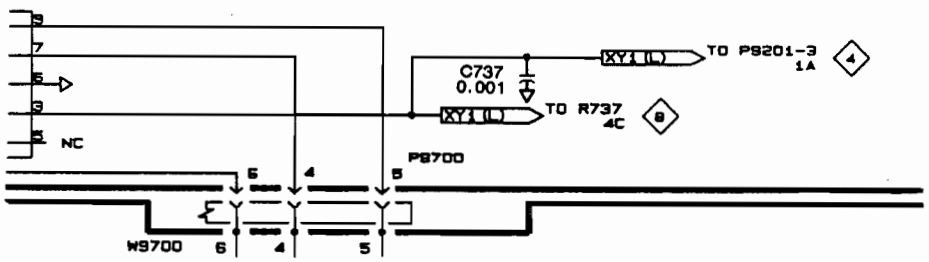
ADD:

A4C737	281-0862-00	CAP,FXD,CER DI: 0.001UF,+80-20%,100V

DIAGRAM CHANGES

DIAGRAM 6 A SWEEP GENERATOR & LOGIC

Add capcitor C737 (0.001 μF) to the XY1 (L) line as shown below. Grid location is 2D.



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MANUAL CHANGE INFORMATION

Date: 4-12-90 Change Reference: M72010

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 40

EFFECTIVE SERIAL NUMBER: B015000

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1	671-1418-01	CIRCUIT BD ASSY: MAIN
A4	671-1420-01	CIRCUIT BD ASSY: TIMING
A5	671-1422-01	CIRCUIT BD ASSY: ALT SWEEP
A1C350	281-0893-00	CAP,FXD,CER DI: 4.7PF,+/-0.5PF,100V
A1C965	290-1129-00	CAP,FXD,ELCTLT: 1000UF,+100%-10%,12V
A1CR501	152-1107-00	DIODE,SIG: SCHTKY,40V,350MA,12PF
A1R210	313-1431-00	RES,FXD,FILM: 430 OHM,5%,0.2W
A1R407	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R448	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R449	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R453	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R463	322-3196-00	RES,FXD,FILM: 1.07K OHM,1%,0.2W
A1R646	311-2257-00	RES,VAR,NONWW: TRMR,500 OHM,20%,0.5W
A1R482	322-3101-00	RES,FXD,FILM: 110 OHM,1%,0.2W
A4R754	311-2227-00	RES,VAR,NONWW: TRMR,100 OHM,20%,0.5W LINEAR
A5R621	322-3196-00	RES,FXD,FILM: 1.07K OHM,1%,0.2W
A5R651	322-3285-00	RES,FXD,FILM: 9.09K OHM,1%,0.2W
A5R652	311-2273-00	RES,VAR,NONWW: TRMR,2K OHM,20%,0.5W
A5R653	322-3298-00	RES,FXD,FILM: 12.4K OHM,1%,0.2W

REMOVE:

A1C363	281-0862-00	CAP,FXD,CER DI: 0.001UF,+80-20%,100V
A1C646	290-0776-04	CAP,FXD,ELCTLT: 22UF,20%,10V,MI
A1C881	290-0946-00	CAP,FXD,ELCTLT: 270UF,+100-10%,40V
A1CR641	152-0951-00	DIODE,SIG:SCHTKY,60V,2.25PF
A1Q446	151-0188-05	TRANSISTOR: PNP,SI,TO-92
A1Q450	151-0190-09	TRANSISTOR: NPN,SI,T0-92
A1Q641	151-0190-09	TRANSISTOR: NPN,SI,T0-92
A1R439	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R445	313-1470-00	RES,FXD,FILM: 47 OHM,5%,0.2W
A1R446	322-3289-00	RES,FXD,FILM: 10K OHM,1%,0.2W
A1R641	313-1472-00	RES,FXD,FILM: 4.7K OHM,5%,0.2W
A1R647	322-3193-00	RES,FXD,FILM: 1K OHM,1%,0.2W
A1W591	131-0566-00	BUS,CONDUCTOR: DUMMY RES,0.094 OD X 0.225 L
A4CR731	152-0141-02	SEMICOND DVC,DI: SW,SI,30V,150MA,30V,DO-35
A4VR749	152-0744-00	SEMICOND DVC,DI: ZEN,SI,3.6V,5%,0.4W

REPLACEABLE ELECTRICAL PARTS LIST CHANGES (cont)

ADD:

A1C370	281-0811-00	CAP,FXD,CER DI: 10PF,10%,100V
A1C452	281-0862-00	CAP,FXD,CER DI: 0.001UF,+80-20%,100V
A1C456	281-0775-01	CAP,FXD,CER DI: 0.1UF,20%,50V
A1C883	290-0920-01	CAP,FXD,ELCTLT: 33UF,35V,20%,AL
A1C884	290-0920-01	CAP,FXD,ELCTLT: 33UF,35V,20%,AL
A1CR966	152-0400-00	DIODE,RECT: FAST RCVRY,400V,1A,200NS
A1L591	108-1488-00	COIL,RF: FXD,1UH,10%
A1R370	322-3085-00	RES,FXD,FILM: 75 OHM,1%,0.2W
A1R456	313-1220-00	RES,FXD,FILM: 22 OHM,5%,0.2W
A1U427	156-0158-00	IC,LINEAR: BIPOLAR,OP-AMP,DUAL
A1W439	131-0566-00	BUS,CONDUCTOR: DUMMY RES,0.094 OD X 0.225 L
A4U749	156-0991-02	MICROCKT,LINEAR: VOLTAGE REGULATOR

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

DIAGRAM CHANGES

DIAGRAM 2 VERTICAL PREAMPS & SWITHCING

Change the value of resistor R448 (location 5G) to 47 Ω.

Change the value of resistor R449 (location 4G) to 47 Ω.

DIAGRAM 3 VERTICAL OUTPUT AMPLIFIER

Change the value of resistor R210 (location 3B) to 430 Ω.

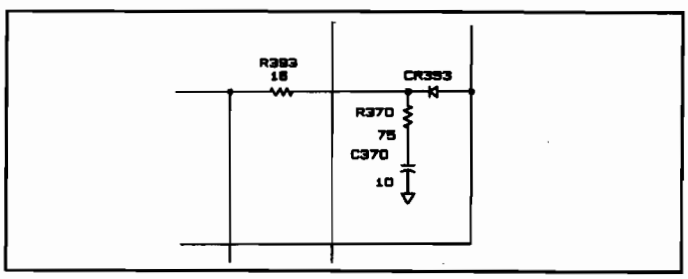
DIAGRAM 4 TRIGGER SELECT

Change the value of capacitor C350 (location 5F) to 4.7 pF.

Note: *This capacitor was added at an earlier date and may not yet appear on the schematic diagram. If not, see Change Reference M71187.*

Remove capacitor C363 (location 4G) from the circuit.

Add resistor R370 (75 Ω) and capacitor C370 (10pF) as shown below. Grid location is 3H.



MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

DIAGRAM CHANGES

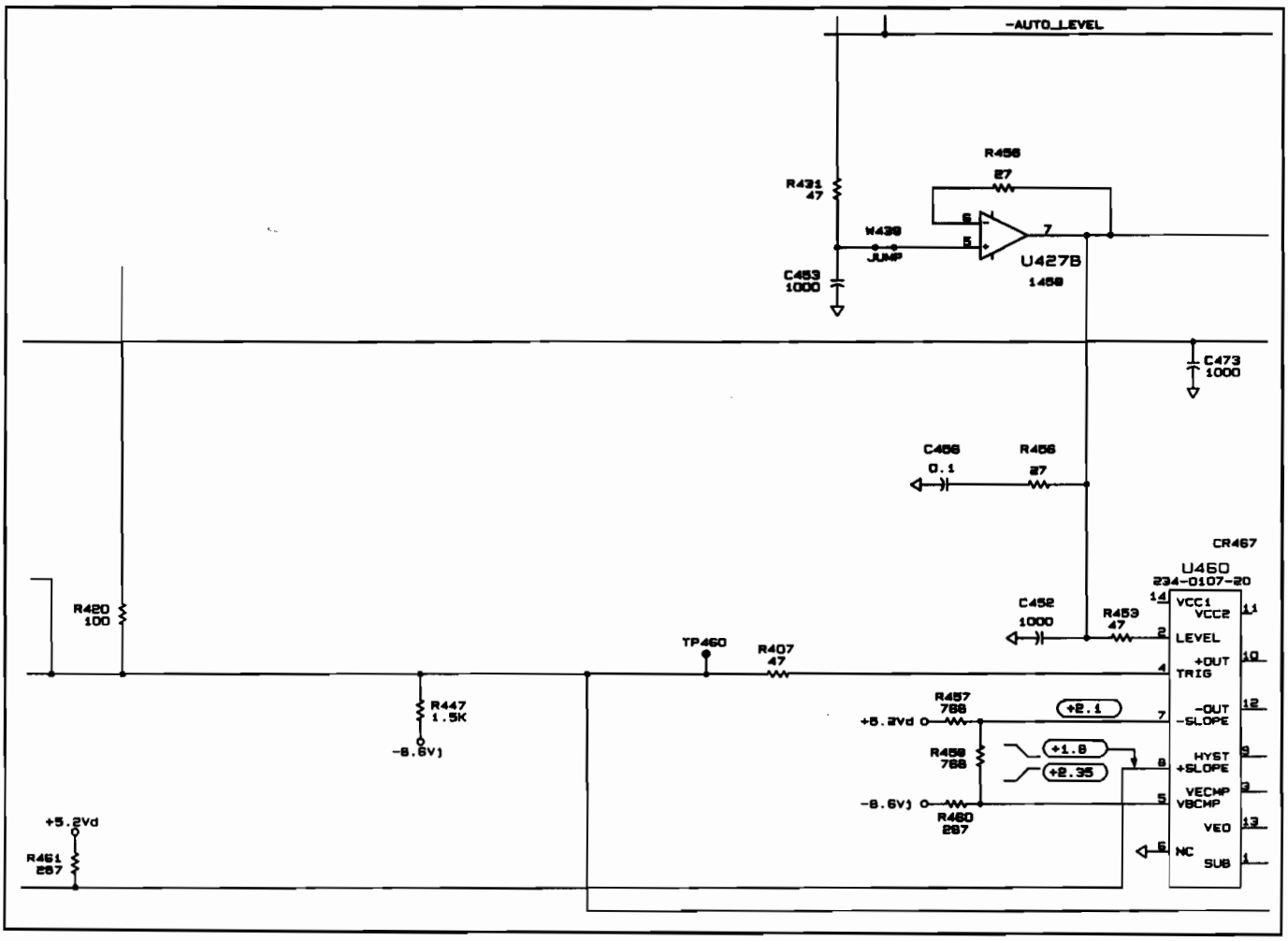
DIAGRAM 5 TRIGGER P-P AUTO & OUTPUT

Change the value of resistor R482 (location 4G) to 110 Ω.

Change the value of resistor R463 (location 5F) to 1.07K Ω.

The following parts changes and circuit wiring changes are illustrated with the partial schematic below.

Remove	Add	Move Location
R439	U427	R447
R445	W439	R407
R446	C456	R450
Q446	R456	
Q450	C452	



MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

DIAGRAM CHANGES

DIAGRAM 7 B TIMING & ALTERNATE SWEEP

Change the value of resistor R621 (location 5F) to 1.07K Ω.

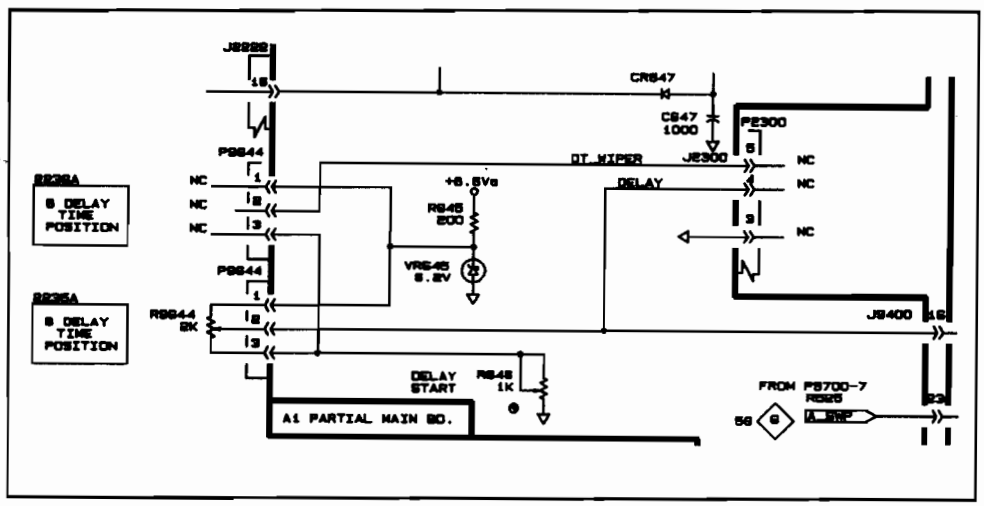
Change the value of resistor R651 (location 3D) to 9.09K Ω.

Change the value of variable resistor R652 (location 3D) to 2K Ω.

Change the value of resistor R653 (location 4D) to 12.4K Ω.

The following parts changes and circuit wiring changes are illustrated with the partial schematic below.

Remove	Add
CR641	J9645
C646	
Q641	
R641	
R647	



MANUAL CHANGE INFORMATION

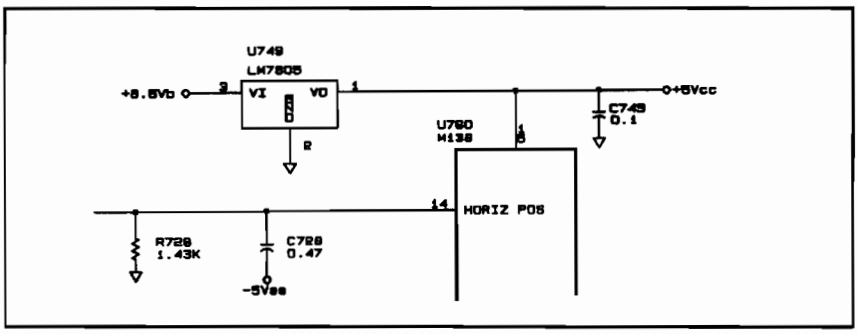
Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

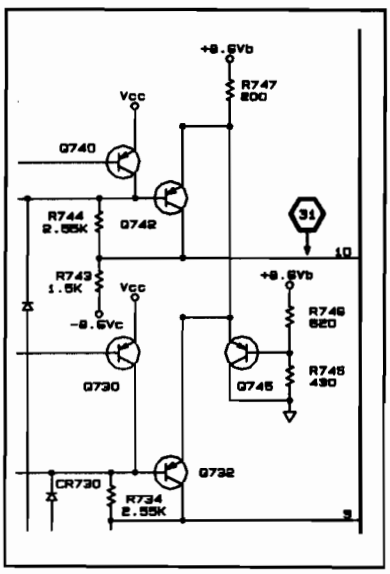
DIAGRAM CHANGES

DIAGRAM 8 CALIBRATOR & HORIZONTAL OUTPUT AMPLIFIER

Add U749 and remove VR749 from pin 15 of U760 (location 1D). See the partial schematic below.



Reconnect the emmiters of Q740 and Q730 as indicated below.



MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

DIAGRAM CHANGES

DIAGRAM 10 PWR SUPPLY, Z-AXIS, & CRT

Remove capacitor C881 (location 5B) and replace with capacitors C883 and C884 (33 μF each).

Add diode CR966 from T948 pin 19 to the anode of diode CR965 (location 5D-E). See partial below.

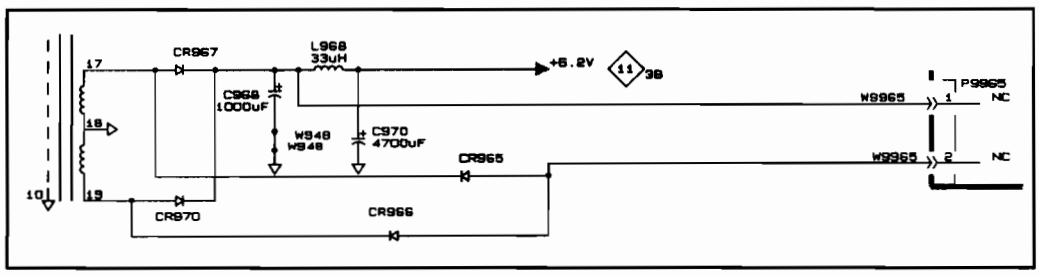


DIAGRAM 11 POWER DISTRIBUTION

Replace wire jumper W591 (location 4E) with coil L591 (1 μH).

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

A4—TIMING BOARD

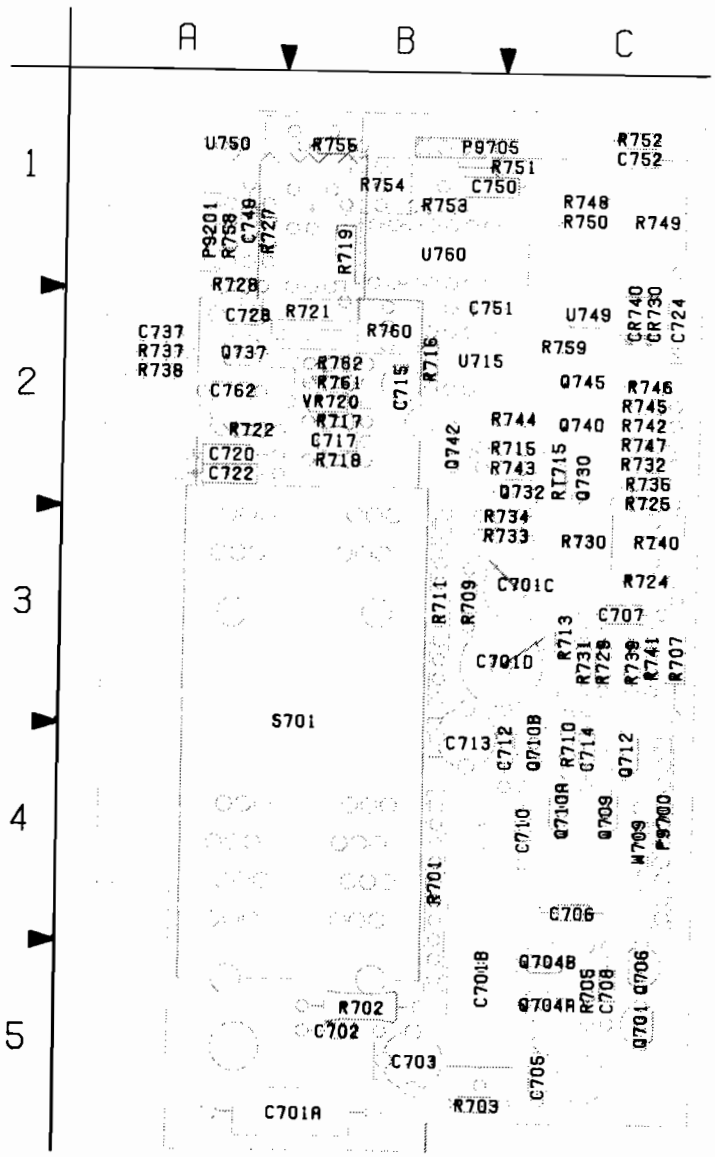
ASSEMBLY A4

CIRCUIT NUMBER	SCHEM NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	BOARD LOCATION
C701	6	5A	P9700	6	4C	R718	6	2B	R750	8	1C
C701	7	5B	P9705	8	1B	R719	6	1B	R751	8	1B
C702	6	5B				R721	6	2B	R752	8	1C
C703	6	5B	Q701	6	5C	R722	6	2A	R753	8	1B
C705	6	5C	Q704	6	5C	R724	8	3C	R754	8	1B
C706	6	4C	Q706	6	5C	R725	8	2C	R755	8	1B
C707	8	3C	Q709	7	4C	R727	8	1A	R758	8	1A
C708	6	5C	Q710	7	4C	R728	8	2A	R759	8	2C
C710	7	4C	Q712	7	4C	R729	8	3C	R760	8	2B
C712	7	4C	Q730	8	2C	R730	8	3C	R761	8	2B
C713	7	4B	Q732	8	2C	R731	8	3C	R762	8	2B
C714	7	4C	Q737	8	2A	R732	8	2C			
C715	6	2B	Q740	8	2C	R733	8	3B	RT715	6	2C
C717	6	2B	Q742	8	2B	R734	8	3B			
C720	6	2A	Q745	8	2C	R735	8	2C	S701	6	4A
C722	6	2A				R737	8	2A	S701	7	4A
C724	8	2C	R701	6	4B	R738	8	2A	S721	8	1A
C728	8	2A	R702	6	5B	R739	8	3C			
C749	8	1A	R703	6	5B	R740	8	3C	U715	6	2B
C750	8	1B	R705	6	5C	R741	8	3C	U715	8	2B
C751	8	2B	R707	6	3C	R742	8	2C	U749		2C
C752	8	1C	R709	7	3B	R743	8	2B	U750	8	1A
C762	8	2A	R710	7	4C	R744	8	2B	U760	8	1B
			R711	7	3B	R745	8	2C			
CR730	8	2C	R713	7	3C	R746	8	2C			
CR740	8	2C	R715	6	2B	R747	8	2C	VR720	6	2B
			R716	6	2B	R748	8	1C			
P9201	6	1A	R717	6	2B	R749	8	1C	W709	7	4C

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40



A4—TIMING BOARD

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

A1 – MAIN BOARD

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	2	3D	C502	6	10C	C941	9	8K	CR902	9	6M
C114	2	4C	C503	6	7E	C942	9	10L	CR903	9	6N
C115	2	4D	C504	6	8E	C943	9	10L	CR904	9	6M
C116	3	4C	C505	6	8E	C944	9	9L	CR907	9	8K
C120	3	5C	C506	6	9F	C945	9	10M	CR908	9	9L
C125	2	3D	C507	11	7C	C954	10	8H	CR920	9	9M
C126	2	3D	C517	6	7E	C956	10	8H	CR946	9	11K
C127	2	3D	C518	6	8F	C957	10	7H	CR947	9	10K
C130	2	3C	C519	6	8F	C960	10	10H	CR948	9	10M
C133	2	2J	C520	6	8F	C961	10	10H	CR954	10	9H
C150	2	3F	C525	6	8F	C962	10	11H	CR955	10	9H
C164	2	4E	C527	6	9F	C963	10	11H	CR956	10	9H
C165	2	4E	C529	6	10F	C965	10	10J	CR957	10	9H
C175	2	3E	C531	6	10E	C968	10	9J	CR960	10	9H
C176	2	3E	C537	3	1M	C970	10	11J	CR961	10	9H
C177	2	3E	C538	2	4J	C975	10	6K	CR962	10	9H
C180	2	3E	C539	2	4J	C976	10	6K	CR963	10	9H
C198	2	3C	C540	3	2L	C979	10	6J	CR965	10	10J
C199	2	4E	C540	11	2L	C987	8	2C	CR966		10J
C200	11	4F	C545	2	1M				CR967	10	9J
C201	11	4F	C547	2	2M	CR133	2	2C	CR970	10	9J
C204	3	1E	C565	4	8F	CR183	2	2F			
C210	3	1E	C590	5	8D	CR200	2	3D	DL9210A	3	1D
C215	3	1C	C590	11	8D	CR201	2	3E	DL9210B	3	1E
C220	11	2E	C603	7	7G	CR202	2	2D			
C225	3	2D	C635	7	9G	CR203	2	2E	DS856	10	7J
C226	3	1B	C647	7	8F	CR226	3	2E	DS858	10	7J
C228	3	2E	C648	7	8G	CR227	3	1E	DS870	10	7H
C229	3	1E	C649	7	7G	CR228	3	2E			
C237	3	1F	C673	7	9G	CR229	3	1F	E200	11	5F
C239	3	2F	C764	8	4J	CR372	4	6D	E201	11	5F
C240	3	2F	C771	8	4H	CR393	4	7D	E272	11	2J
C241	3	2F	C774	8	3H	CR399	4	7D	E590	11	10D
C242	3	2F	C775	8	4H	CR405	5	8D	E907	9	7K
C250	3	2G	C777	8	4G	CR406	5	8D			
C251	3	1G	C779	8	3G	CR409	4	6C	J2222	2	7B
C255	3	1G	C781	8	3H	CR414	5	8B	J2222	3	7B
C262	3	2J	C782	8	2H	CR415	5	8C	J2222	4	7B
C274	11	2J	C785	8	3H	CR419	4	6C	J2222	6	7B
C281	3	1G	C787	8	3H	CR467	5	9D	J2223	4	9B
C282	3	7G	C789	8	2G	CR476	5	9B	J2223	5	9B
C292	3	3G	C796	11	3J	CR477	5	9D	J2223	6	9B
C312	4	5D	C797	11	3J	CR501	6	10D	J2300	7	10F
C337	4	5E	C799	11	4G	CR502	6	10D	J2400	11	10F
C350	4	6D	C824	10	8F	CR503	6	8E	J2500	5	10D
C370	4	9C	C825	10	3L	CR508	6	9B	J2600	6	8E
C389	4	11B	C828	10	4L	CR509	6	10C	J2700	10	8G
C390	4	10B	C832	10	3L	CR514	6	9E	J2850	6	8E
C396	9	4K	C835	10	4L	CR518	6	7F	J9100	1	6A
C397	4	5E	C845	10	4M	CR529	6	9F	J9103	2	4D
C402	5	7C	C846	10	3M	CR551	10	7F	J9108	2	4F
C406	4	6C	C847	10	3M	CR564	4	3K	J9400	7	10G
C409	4	7D	C849	10	4N	CR647	7	11E	J9400	11	7G
C410	5	8D	C851	10	4L	CR648	7	8F	J9644	5	11F
C414	5	7B	C853	10	7H	CR649	7	11E	J9645	5	11F
C415	5	8B	C854	10	7J	CR712	7	10F	J9870B	10	1L
C418	4	6C	C855	10	7K	CR764	8	2J	J9882	10	3B
C419	4	7D	C871	10	1L	CR770	8	4J	J9884	8	4B
C420	5	7C	C873	10	1L	CR780	8	3J			
C421	5	8C	C875	10	1K	CR805	10	6F	L266	3	2J
C451	11	8E	C877	10	1L	CR818	10	7F	L267	3	1J
C452	5	8C	C882	10	3B	CR820	10	7F	L451	11	7E
C453	5	9C	C883	10	4B	CR823	10	3L	L499	11	6F
C456	5	9C	C884	10	4B	CR824	10	2M	L591	11	9E
C459	5	8C	C893	10	6H	CR825	10	3M	L956	10	7H
C460	5	8D	C904	9	5M	CR829	10	3M	L960	10	10H
C467	5	8D	C906	9	7L	CR840	10	4M	L961	10	10H
C469	5	9C	C907	9	7M	CR845	10	3M	L968	10	10J
C473	5	9B	C908	9	7M	CR851	10	5L			
C487	5	9D	C917	9	10L	CR853	10	5L	P870	10	7H
C494	11	6E	C919	9	10M	CR854	10	7J	P871	10	7H
C499	11	6D	C922	9	10L	CR855	10	7J	P908	9	7L
C500	6	10C	C925	9	10M	CR882	10	3B	P909	9	9L
C501	6	10C	C940	9	8K	CR901	9	6M	P940	9	8L

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

A1—MAIN BOARD

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
Q102	2	3D	Q840	10	4M	R183	2	2F	R314	4	5E
Q103	2	3D	Q845	10	3M	R185	2	3F	R315	4	4E
Q114	2	4C	Q882	10	2B	R186	2	3F	R317	4	5C
Q115	2	4D	Q885	10	5K	R188	2	3E	R318	4	5C
Q152	2	3F	Q908	9	9L	R189	2	2F	R319	4	4D
Q153	2	3F	Q928	9	9M	R192	2	2E	R320	4	5C
Q164	2	4E	Q930	9	9M	R193	2	2E	R321	4	4D
Q165	2	4E	Q935	9	11M	R194	2	2E	R322	4	4D
Q202	3	2D	Q938	9	10L	R195	2	2E	R324	4	5D
Q203	3	2E	Q939	9	10L	R200	2	3D	R326	4	4F
Q206	3	1D	Q944	9	10L	R202	3	2D	R327	4	3F
Q207	3	1E	Q946	9	10K	R203	3	2D	R328	4	3E
Q230	3	2F				R204	3	2E	R329	4	4F
Q231	3	1F	R100	2	4E	R206	3	2D	R330	4	4E
Q254	3	2G	R101	2	4D	R207	3	2E	R331	4	4F
Q255	3	1G	R102	2	3E	R210	3	1D	R332	4	4E
Q256	3	2H	R103	2	3D	R212	3	1D	R335	4	5E
Q257	3	1H	R104	2	3D	R213	3	1E	R336	4	5E
Q283	3	2G	R105	2	3D	R215	3	1D	R337	4	5E
Q284	3	2G	R106	2	3D	R216	3	2D	R339	4	5E
Q285	3	2G	R108	2	3D	R217	3	2E	R340	4	4E
Q302	4	4D	R109	2	4D	R218	3	1D	R342	4	5C
Q303	4	4D	R113	2	5B	R219	3	1E	R343	4	5C
Q327	4	4F	R114	2	4C	R220	11	2E	R344	4	4E
Q328	4	4E	R115	2	4D	R222	3	1D	R345	4	6C
Q369	4	6C	R116	2	5C	R223	3	1E	R346	4	5E
Q374	4	6B	R117	2	5C	R225	3	1C	R347	4	5E
Q381	4	9B	R118	2	5C	R226	3	1C	R349	4	4E
Q382A	4	10B	R119	2	5B	R227	3	1F	R350	4	6D
Q382B	4	10B	R120	2	4C	R230	3	2F	R351	4	6D
Q384	4	10B	R121	2	4D	R231	3	1F	R352	4	6D
Q392	4	7B	R122	2	4D	R233	3	1G	R353	4	6D
Q397	4	6E	R123	2	4C	R234	3	2F	R354	4	7D
Q399	4	6E	R124	2	3C	R235	3	1F	R356	4	6D
Q400	5	7C	R125	2	3C	R236	3	1F	R357	4	6D
Q402	5	7D	R126	2	3C	R239	3	2F	R358	4	6D
Q405	5	8D	R127	2	3C	R240	3	1F	R359	4	6D
Q408	5	8D	R130	2	3C	R241	3	1F	R360	4	6D
Q409	4	7D	R131	2	3D	R242	3	2F	R361	4	6D
Q413	5	9B	R132	2	1K	R244	3	2F	R363	4	6D
Q419	4	7D	R133	2	2C	R245	3	2F	R364	4	6C
Q420	5	8C	R135	2	3C	R250	3	2G	R365	4	6D
Q421	5	8C	R136	2	3D	R251	3	1G	R366	4	6D
Q422	5	7C	R138	2	3C	R254	3	2G	R367	4	6D
Q423	5	8C	R139	2	2C	R255	3	1G	R368	4	5C
Q428	5	8B	R142	2	2D	R256	3	2H	R369	4	6D
Q429	5	8B	R143	2	2D	R257	3	1H	R370	4	9C
Q440	2	7E	R144	2	2D	R258	3	2G	R372	4	7D
Q441	2	7E	R145	2	2D	R259	3	1G	R373	4	7D
Q473	5	9C	R150	2	4F	R261	3	1H	R374	4	6C
Q474	5	9C	R151	2	4F	R262	3	1J	R375	4	6B
Q476	5	9D	R152	2	3F	R266	3	1H	R381	4	10B
Q477	5	9D	R153	2	3F	R279	3	2F	R382	4	10B
Q487	5	9C	R154	2	3E	R281	3	1F	R383	4	6B
Q501	6	10D	R155	2	3E	R282	3	1G	R384	4	10B
Q509	6	10C	R156	2	3F	R283	3	2G	R385	4	10B
Q511	6	9E	R158	2	3F	R284	3	2G	R386	4	10B
Q525	6	7F	R159	2	4F	R285	3	2F	R387	4	10B
Q555	6	7E	R163	2	5B	R286	3	2G	R388	4	10B
Q576	6	8E	R164	2	4E	R287	3	2G	R389	4	10B
Q578	6	8E	R165	2	4E	R288	3	1G	R390	4	10B
Q583	10	8F	R166	2	4B	R289	3	2G	R391	4	6C
Q586	10	8F	R167	2	4B	R292	3	3F	R392	4	10B
Q768	8	3H	R168	2	4C	R293	3	3F	R393	4	9C
Q770	8	3H	R169	2	4B	R301	4	4D	R394	4	5E
Q775	8	3G	R170	2	4E	R302	4	3D	R395	4	6E
Q778	8	3H	R171	2	4E	R303	4	3D	R396	4	6E
Q779	8	4G	R172	2	4E	R304	4	4D	R397	9	6G
Q780	8	3H	R173	2	3C	R305	4	4D	R398	9	6G
Q785	8	3G	R174	2	4C	R306	4	4D	R399	4	6E
Q789	8	3G	R175	2	3E	R307	4	4D	R400	5	7C
Q804	10	6F	R176	2	3E	R309	4	4C	R402	5	7D
Q814	10	6F	R177	2	3E	R310	4	5D	R403	5	7D
Q825	10	3L	R180	2	3E	R311	4	5D	R404	5	7C
Q829	10	3M	R181	2	3E	R312	4	5D	R405	5	7D
Q835	10	4M	R182	2	2J						

MANUAL CHANGE INFORMATION

Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

A1 – MAIN BOARD

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
R406	5	7D	R507	6	10C	R789	8	3G	R935	9	11M
R407	5	8D	R508	6	10D	R792	8	4G	R937	9	11L
R408	5	8E	R509	6	10C	R793	8	4H	R938	9	11M
R409	4	6C	R510	6	10C	R796	11	3J	R939	9	11L
R410	5	8D	R511	6	9E	R797	11	3J	R940	9	10L
R411	5	8B	R512	6	9E	R799	11	4G	R941	9	10M
R412	5	9B	R513	6	9E	R804	10	6E	R942	9	10L
R413	5	8C	R514	6	9F	R805	10	6F	R943	9	10L
R414	5	8B	R516	6	10D	R814	10	6E	R944	9	10M
R415	5	8C	R517	6	10E	R818	10	7F	R945	9	10L
R416	5	8C	R518	6	9E	R820	10	7F	R946	9	10L
R417	5	8C	R523	6	8F	R822	10	3M	R947	9	9L
R419	4	6C	R524	6	8F	R823	10	2M	R948	9	10N
R420	5	8C	R525	6	8F	R825	10	4L	R949	9	10L
R421	5	8C	R526	6	9F	R826	10	2M	R964	11	4L
R422	5	7C	R527	6	9F	R828	10	2J	R975	10	6K
R423	5	8C	R528	6	10E	R830	10	3M	R976	10	6J
R424	5	7C	R529	6	10F	R832	10	3M	R978	10	6J
R426	5	8C	R540	2	2L	R834	10	4L	R984	8	1B
R427	5	8C	R541	2	2K	R835	10	4L	R985	8	2B
R428	5	7B	R544	2	2M	R836	10	4L	R986	8	2B
R429	5	9B	R545	2	1M	R840	10	4L	R987	8	2B
R431	5	9B	R547	2	2M	R841	10	4M	R988	8	2B
R432	5	9B	R548	2	2M	R842	10	4M	R989	8	2C
R433	5	9B	R549	2	2M	R843	10	4L	R990	8	1C
R434	5	9B	R550	4	6B	R844	10	3M	R991	8	2B
R435	5	9B	R554	6	7E	R845	10	3M			
R436	5	9A	R555	6	7E	R846	10	3M	RT236	3	2F
R437	5	9B	R564	4	3K	R849	10	3M	RT763	4	6F
R440	2	7D	R565	4	4K	R851	10	4M			
R441	2	7D	R566	8	7F	R852	10	4M	S901	9	5M
R442	2	8E	R568	6	10E	R853	10	7H			
R443	2	8E	R569	6	10E	R854	10	7J	T390	9	6L
R444	2	8E	R571	6	9E	R855	10	4L	T906	9	8L
R447	5	8C	R572	6	10F	R858	10	7J	T944	9	9K
R448	2	2E	R573	6	10E	R860	10	7H	T948	10	8J
R449	2	2D	R574	6	10F	R870	10	1K			
R450	5	8C	R576	6	9E	R871	10	1K	TP842	10	4L
R452	5	8C	R577	6	9E	R872	10	1K	TP940	9	10M
R453	5	8C	R578	6	9E	R873	10	1K	TP950	9	9L
R455	5	8C	R580	6	8F	R874	10	1K	TP961	11	10F
R456	5	9C	R582	6	8E	R875	10	1K			
R457	5	9D	R583	10	8F	R877	10	1K	U120	2	4C
R458	5	9D	R586	10	8F	R880	10	2B	U130	2	3D
R459	5	8C	R591	5	9D	R881	10	5B	U180	2	2E
R460	5	9C	R645	7	10F	R883	10	3C	U225	3	1D
R461	5	9D	R646	7	10F	R884	10	3C	U310	4	4D
R462	5	9C	R648	7	11E	R885	10	5K	U335	4	4E
R463	5	8D	R649	7	11E	R886	10	5J	U350	4	6D
R464	5	8D	R673	7	9G	R887	10	3B	U426	5	7B
R465	5	9D	R676	8	7F	R888	10	2C	U427	5	8C
R467	5	9D	R757	4	6D	R889	10	3C	U460	5	8D
R468	5	8D	R763	4	6F	R890	10	6H	U502	6	10C
R469	5	9D	R764	8	3J	R891	10	3C	U504	6	8E
R470	5	8D	R766	8	3H	R893	10	5H	U506	6	9E
R473	5	10B	R768	8	3H	R905	9	5L	U532	6	10E
R474	5	10C	R770	8	4H	R906	9	6L	U537	2	2M
R476	5	9D	R771	8	5G	R907	9	8K	U540	2	2L
R477	5	9D	R772	8	3H	R908	9	9L	U555	4	6B
R478	5	9C	R773	8	3G	R909	9	9L	U565	4	2K
R479	5	9C	R774	8	3H	R912	9	9L	U882	10	3C
R480	5	9D	R775	8	4H	R913	9	9M	U930	9	10M
R481	5	9D	R776	8	4G	R914	9	9L	U975	10	5J
R482	5	9D	R777	8	4G	R915	9	10L	U985	8	1B
R486	5	9D	R778	8	3G	R916	9	10M			
R487	5	9D	R779	8	4G	R917	9	9L			
R492	5	10D	R780	8	3H	R919	9	10M	VR200	2	3E
R494	11	7F	R781	8	5G	R921	9	10M	VR645	7	10F
R500	6	10C	R782	8	2H	R922	9	10M	VR712	7	10F
R501	6	10C	R783	8	3H	R925	9	9M	VR764	8	3J
R502	6	10D	R784	8	3H	R926	9	9M	VR782	8	2H
R503	6	10D	R785	8	3H	R927	9	9M	VR828	10	3L
R504	6	6E	R786	8	3G	R928	9	9M	VR925	9	9M
R505	6	7E	R787	8	3G	R929	9	9M	VR935	9	11M
R506	6	10D	R788	8	3G	R930	9	9M	VR943	9	10L

MANUAL CHANGE INFORMATION

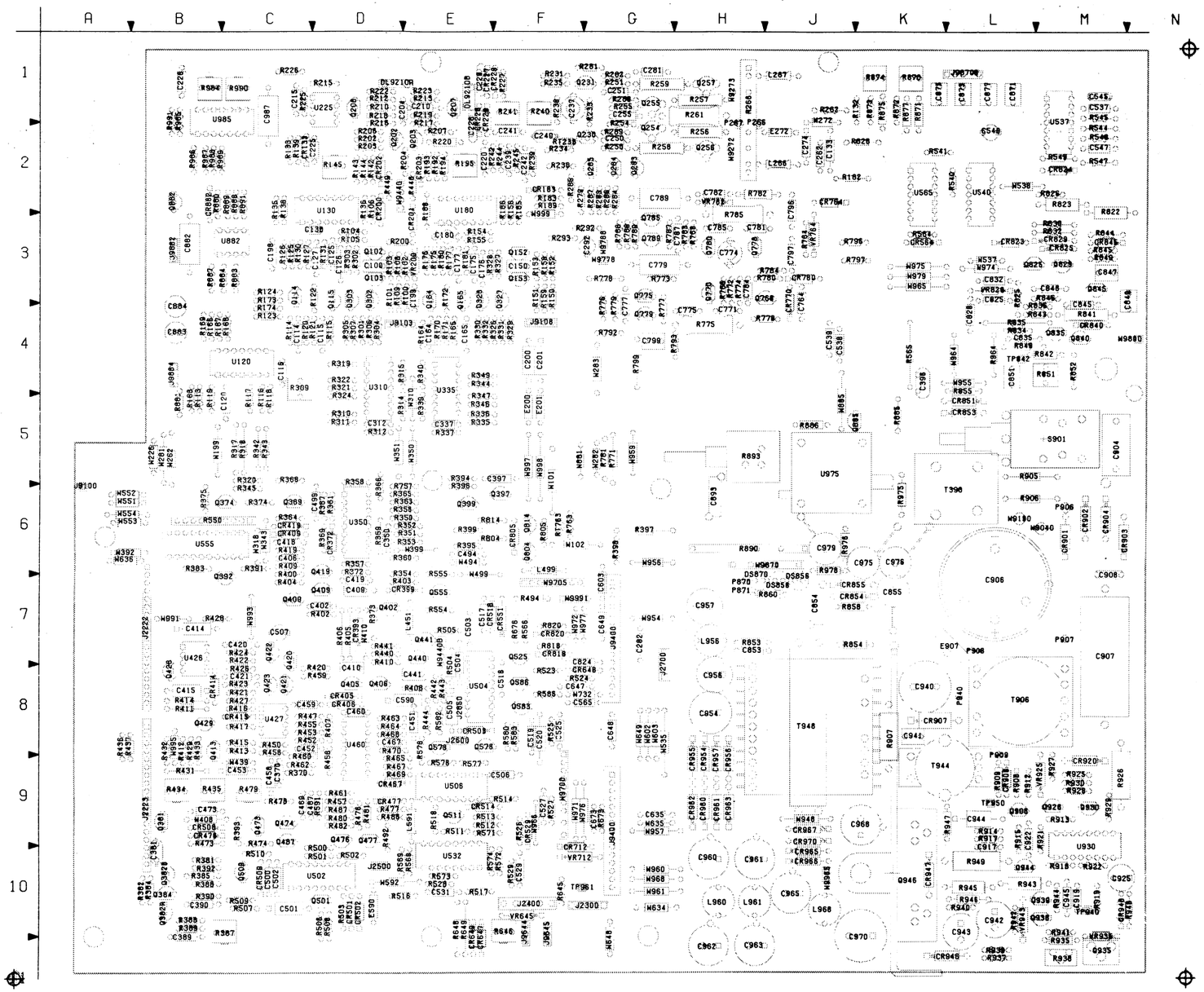
Product: 2235A SERVICE Date: 4-12-90 Change Reference: M72010

DESCRIPTION Product Group 40

A1 – MAIN BOARD

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
W101	1	6F	W499	11	7E	W954	11	7G	W995	11	9B
W102	1	6F	W535	2	8G	W955	11	4L	W997	11	5F
W199	2	5B	W537	2	3L	W956	11	6G	W998	11	5F
W226	3	5B	W538	2	2L	W957	11	9G	W999	11	3F
W262	3	5B	W551	4	6A	W959	11	5G	W9040	9	6L
W272	11	2J	W552	4	6A	W960	11	10G	W9190	9	6L
W281	3	5B	W553	4	6A	W961	11	10G	W9272	3	2H
W282	3	5G	W554	4	6A	W964	11	4L	W9273	3	1H
W283	3	4G	W592	11	10D	W965	11	3K	W9440	2	2D
W310	4	5E	W602	7	8G	W966	11	9F	W9700	6	9F
W318	4	6C	W603	7	8G	W968	11	10G	W9700	7	9F
W343	4	6C	W634	7	10G	W971	11	9F	W9700	8	9F
W350	4	5E	W635	7	9G	W972	11	7F	W9705	11	7F
W351	4	5D	W636	4	6A	W974	11	3L	W9778	8	3G
W392	4	6A	W648	7	11G	W975	11	3K	W9788	8	3G
W399	4	6E	W649	7	8G	W976	11	9G	W9800	10	4M
W408	11	9B	W732	8	8F	W977	11	7G	W9870	10	6H
W410	5	7D	W881	10	5F	W979	11	3K	W9965	10	10J
W439	5	9C	W885	10	5J	W991	11	7B	W9991	1	7F
W494	11	6E	W948	10	8J	W993	11	7C	W9991	10	7F



A1 – MAIN BOARD

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MANUAL CHANGE INFORMATION

Date: 05-09-90 Change Reference: M73007

Product: 2235A INSTRUCTION MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B015150

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

DELETE:

A1W410	131-0566-00	BUS CONDUCTOR: DUMMY RES,0.094 OD X 0.225 L W/WIRELEADS.

ADD:

A1R418	313-1100-00	RES,FXD,FILM: 10 OHM,5% 0.2W.

DIAGRAM CHANGES

DIAGRAM 5 TRIGGER P-P AUTO & OUTPUT

Replace W410 with R418 (grid location 4B) 10 Ohm resistor.

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MANUAL CHANGE INFORMATION

Date: 5-22-91 Change Reference: M73296

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1R312	322-3102-00	B016189	RES,FXD,FILM:113 OHM,1%,0.2W
A1R337	322-3102-00	B016189	RES,FXD,FILM:113 OHM,1%,0.2W
A1R525	322-3321-00	B016189	RES,FXD,FILM:21.5K,1%,0.2W
A1R643	322-3321-00	B016189	RES,FXD,FILM:21.5K,1%,0.2W
A1R832	322-3218-00	B016189	RES,FXD,FILM:1.82K,1%,0.2W
A5R640	313-1124-00	B015622	RES,FXD,FILM:120K,5%,0.2W

REMOVE:

A1C825	281-0767-00	B016189	CAP,FXD,CER DI:330PF,20%,100V

DIAGRAM CHANGES

DIAGRAM 4 TRIGGER SELECT

Change the value of resistor R312 (location 4D) to 113 Ω.
Change the value of resistor R337 (location 5E) to 113 Ω.

DIAGRAM 6 A SWEEP GENERATOR & LOGIC

Change the value of resistor R525 (location 5G) to 21.5K Ω.

DIAGRAM 7 B TIMING & ALTERNATE B SWEEP

Change the value of resistor R643 (location 4E) to 21.5K Ω.
Change the value of resistor R640 (location 4F) to 120K Ω.

DIAGRAM 10 POWER SUPPLY SECONDARIES, Z-AXIS, & CRT

Change the value of resistor R832 (location 1F) to 1.82K Ω.
Delete the 330pf capacitor C825 (location 1E).

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MANUAL CHANGE INFORMATION

Date: 5-23-91 Change Reference: M73463

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B016189

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1CR518	152-0040-00	SEMICOND DVC,DI:RECT,SI,600V,1A,DO-41

REMOVE:

A1L591	108-1488-00	COIL,RF:FXD,1UH,10%

ADD:

A1W591	131-0566-00	BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L

DIAGRAM CHANGES

DIAGRAM 11 POWER DISTRIBUTION

Replace coil L591 (1 μH, location 4E) with wire jumper W591.

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MANUAL CHANGE INFORMATION

Date: 4-29-91 Change Reference: M73756

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B016399

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1U540	156-1756-00	IC, DIGITAL: ALSTTL, FLIP FLOP; DUAL D-TYPE W/CLEAR; 74ALS74, DIP14.3

DIAGRAM CHANGES

DIAGRAM 2 VERTICAL PREAMPS & SWITCHING

Change the vendor number of U540A&B (location 5E & 5C) to 74ALS74.

MANUAL CHANGE INFORMATION

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Date: 5-24-91 Change Reference: M74671

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B017680

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1R568	313-1302-00	RES,FXD,FILM:3.0K OHM,5%,0.2W
A1R516	313-1332-00	RES,FXD,FILM:3.3K OHM,5%,0.2W
A1R757	322-3203-00	RES,FXD,FILM:1.27K OHM,1%,0.2W
A1R763	322-3097-00	RES,FXD,FILM:100 OHM,1%,0.2W

ADD:

A1RT763	307-0125-00	RES,THERMAL:500 OHM,10%,NTC

DIAGRAM CHANGES

DIAGRAM 4 TRIGGER SELECT

Change the value of resistor R757 (location 5G) to 1.27K Ω.
Change the value of resistor R763 (location 5H) to 100 Ω.
Add RT763, a 500 Ω thermistor, in parallel with R763 (location 5H).

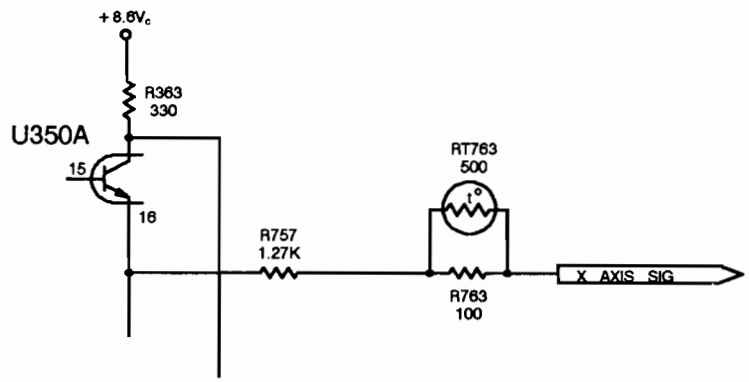

DIAGRAM 6 A SWEEP GENERATOR & LOGIC

Change the value of resistor R516 (location 5F) to 3.3K Ω.
Change the value of resistor R568 (location 4C) to 3.0K Ω.

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MANUAL CHANGE INFORMATION

Date: 7-26-91 Change Reference: M75163

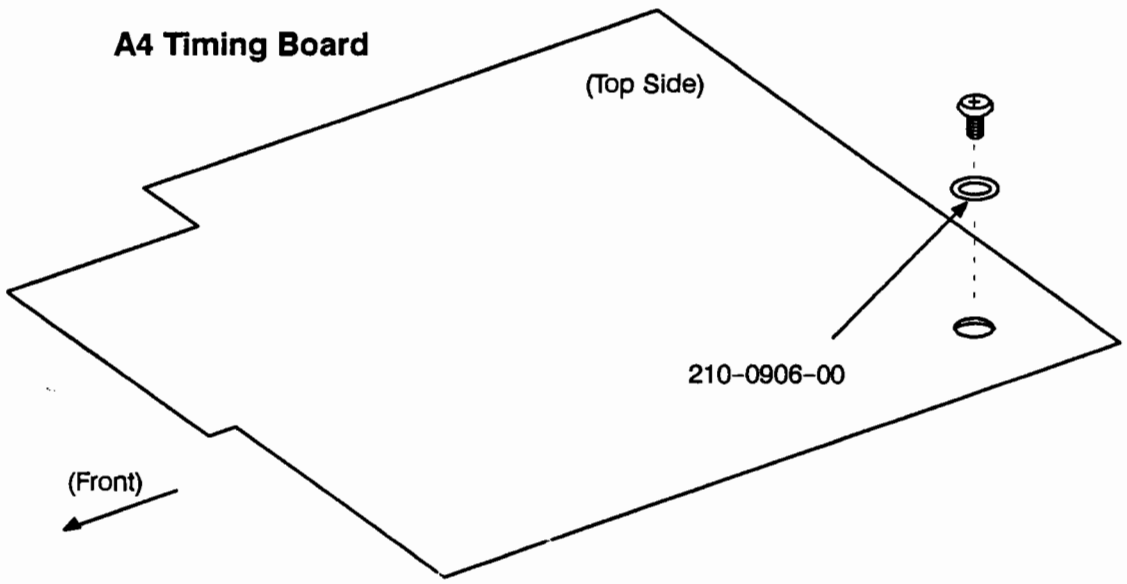
Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B018291

REPLACEABLE MECHANICAL PARTS LIST CHANGES

Fig & Index No.	Part No.	Qty	NAME & DESCRIPTION
ADD:			
3-42	210-0906-00	1	WASHER,FLAT:0.125 OD X 0.2 OD X 0.035,FBR



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MANUAL CHANGE INFORMATION

Date: 7-30-91 Change Reference: M74522

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

EFFECTIVE SERIAL NUMBER: B018586

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

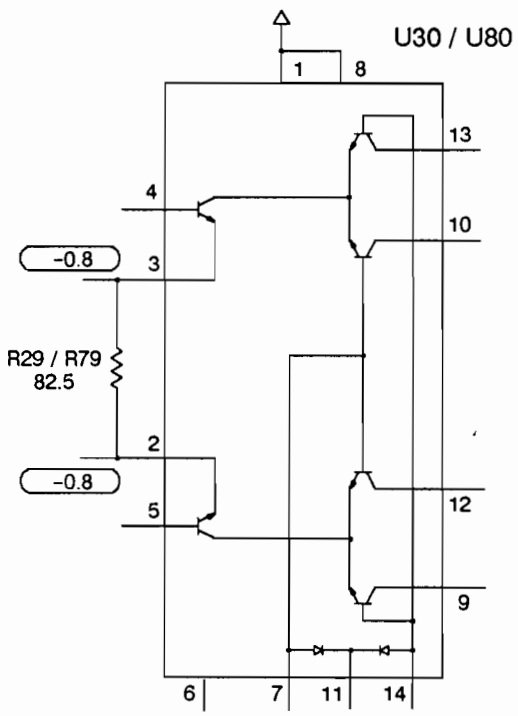
CHANGE TO:

A2R29	322-3089-00	RES,FXD,FILM:82.5 OHM,1%,0.2W,TC=T0MI,SMALL BODY
A2R79	322-3089-00	RES,FXD,FILM:82.5 OHM,1%,0.2W,TC=T0MI,SMALL BODY
A2U30	155-0273-01	IC,ASIC:BIPOLAR,LINEAR,AMPLIFIER
A2U80	155-0273-01	IC,ASIC:BIPOLAR,LINEAR,AMPLIFIER

DIAGRAM CHANGES

DIAGRAM 1 CH1 & CH2 ATTENUATORS

Change the value of resistor R29 (location 2F) to 82.5 Ω.
Change the value of resistor R79 (location 4F) to 82.5 Ω.
Replace the U30 and U80 internal schematic with the one given below:



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MANUAL CHANGE INFORMATION

Date: 7-30-91 Change Reference: M73902

Product: 2235A SERVICE MANUAL Manual Part Number: 070-7683-00

DESCRIPTION Product Group 46

REPLACEABLE ELECTRICAL PARTS LIST CHANGES

CHANGE TO:

A1C100	281-0893-00	B017886	B018646	CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V TUBULAR,MI
A1C100	283-1036-00	B018647		CAP,FXD,CER DI:4.7PF,100V,MI
A1C150	281-0893-00	B017886	B018646	CAP,FXD,CER DI:4.7PF,+/-0.5PF,100V TUBULAR,MI
A1C150	283-1036-00	B018647		CAP,FXD,CER DI:4.7PF,100V,MI

DIAGRAM CHANGES

DIAGRAM  **VERTICAL PREAMPS & SWITCHING**

Change the value of capacitor C100 (location 1B) to 4.7 pF.
Change the value of capacitor C150 (location 3B) to 4.7 pF.